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ANNUAL REPORT OF THE AGRICULTURAL CHEMIST FOR 1923.

By B. J. Eaton.

Staff.—The scientific staff during the year was as follows :—

Agricultural Chemist	B. J. Eaton
Asst. Agricultural Chemist	R. O. Bishop
,, ,, ,,	C. D. V. Georgi
,, ,, ,,	V. R. Greenstreet
,, ,, ,,	J. H. Dennett.

The Agricultural Chemist was absent in Australia from the 6th July till 17th October. Mr. R. O. Bishop acted as Agricultural Chemist during this period.

Mr. J. H. Dennett was on leave from the 2nd February till the 15th May.

Mr. R. O. Bishop proceeded on service leave on the 19th October.

Organisation.—The Agricultural Chemist has been responsible for the compilation of all reports and administration and general supervision of all chemical work.

Rubber investigations, and the experimental work on paper pulp and fibres was under the supervision of Mr. R. O Bishop until he proceeded on leave, when Mr. J. H. Dennett took charge of this work.

Major C. D. V. Georgi has been in charge of investigations on oils and fats and forest products of various kinds.

Mr. J. H. Dennett has been in charge of investigations on raw materials for the production of power alcohol and sugar with particular reference to the tapping of nipah palm and the production of alcohol and sugar from the sap of this palm.

Mr. V. R. Greenstreet has been in charge of investigations on soils and fertilisers and various miscellaneous investigations.

Rubber Investigations.

Researches on problems connected with the quality of raw rubber and the factors affecting variability in vulcanisation have been continued throughout the year.

The following articles have been published on some of the results of these investigations.

"The effect of the oxides of arsenic on the rate of vulcanisation of rubber"

"The deterioration of raw rubber on storage"

A number of experiments have been carried out on methods of preservation of latex in the liquid state for shipment and export.

For many purposes it has been confirmed that ammonia is very satisfactory, although the danger attendant on the use of the strongest commercial solution must not be ignored.

Experiments on the loss of ammonia incurred in pumping latex from one vessel to another and on exposure of the ammoniated latex to the atmosphere have also been carried out.

Experiments have shown that ammonia added to latex increases the time of cure of the rubber prepared from such latex.

Investigations on the method of determination of nitrogen in raw rubber, would appear to indicate that the Kjeldahl method of determination does not include all the nitrogen compounds in rubber and latex. Further investigation on this problem is necessary.

Investigations are in progress on the vulcanisation of rubber with solutions of sulphur chloride with a view to evolving a new method for the laboratory examination of raw rubber.

Further investigations on slab rubber, which are in progress, have yielded interesting results in connection with the difference between the exterior and interior layers of the thick slab and on methods of drying and maturation.

Investigations on sprayed rubber prepared by the Hopkinson's process, United States Rubber Plantations Inc. (General Rubber Co. of New York) have been carried out and are still in progress.

Investigations on the effect of various constituents of the latex incorporated in raw rubber are in progress and a report has already been published in the Malayan Agricultural Journal.

Investigations have been carried out on rubber mixings for the manufacture of soles, flooring-tiles, and for sealing rings for tin cans for packing pine-apples.

The cold vulcanisation by sulphur chloride of rubber samples coloured by the addition of organic dyestuffs to latex has been carried out for an estate.

Several patent coagulants and anti-coagulants have been examined and reported on and rubber prepared by their use has been investigated. Assistance has been rendered to estates in connection with the preservation, packing and shipment of latex and a number of reports containing advice on the same subject have been prepared.

A number of samples of rubber containing defects such as bubbles, "rust" and spot disease have been received and reported on.

A sample of adulterated rubber was received for examination. This was found to contain an excess of mineral matter, amounting in one sample to 19.0 per cent. The adulterant was China Clay.

Oils and Fats.

Fixed Oils & Fats.—Samples of groundnut oil and residual cake prepared in Chinese Wedge presses have been examined. The small percentage of oil in the cake indicated that this type of press is fairly efficient; its chief disadvantage is that the ground seed-meal has to remain in the press for many hours.

A number of samples of oil-palm fruit and palm oil have been examined and the free fatty acid content of samples of the oil determined. All samples, except one, were received from one estate.

Analyses of the fruits examined was found to be in close agreement with samples examined during 1922.

Samples of copra cake from one of the copra oil mills in Malaya have been examined to ascertain the efficiency of the mill and recommendations made to increase the efficiency.

An investigation of Illipe nuts of different species and origin has been carried out. The nuts are imported from Borneo, Siak and Pontianak and sent from Singapore to Europe, where the fat is expressed and is used for the manufacture of chocolates and soap.

The oil content of Roselle seed has been determined and the characteristics of the oil ascertained.

The oil content of a sample of Tengkawang seeds, received from the Conservator of Forests, British North Borneo, has been determined.

Lime Fruit Products.

No further investigations have been carried out during the year, but a visit was paid to the estate cultivating this crop in connection with the consignment of hand-pressed oil of limes, distilled oil of limes and concentrated lime juice to England.

A sample of Kapok seed oil has been examined and reported on.

Essential Oils.

A sample of an unknown essential oil, probably a wood oil, has been examined and found to be of little commercial value.

Samples of vetiver (*cus-cus*) grass roots from Serdang Experimental Plantation have been distilled on a semi-commercial scale and a bale of the roots and sample of the oil have been despatched to the Malay States Information Agency for valuation and report.

Assistance and advice has been rendered to one estate in connection with the distillation of citronella oil and the efficiency of an unsatisfactory still and condenser has been improved.

The oil content of several samples of grass from this estate was determined and a large batch of grass from Serdang Experimental Plantation has also been distilled and the oil examined.

Enquiries have been received recently from the Malay States Information Agency for Patchouli oil and investigations are being made. The cultivation of this crop is being revived in Johore.

Citronella grass should prove profitable as a crop at present prices (about 4/9 per lb). The oil from the Malayan Citronella grass is similar in quality to the Java and Burmah oils.

Paper Pulp Investigations.

Samples of paper pulp (and the raw materials) from various bamboos and grasses prepared at the Department of Agriculture have been forwarded to the Forest Research Institute, Dehra Dun, India, to the United Kingdom and to Denmark.

A batch of pulp from bamboos has also been prepared for another syndicate, which is interested in this product.

A batch of pulp has also been prepared and despatched for the making of various exhibits in the Agricultural Section of the Malayan Pavilion of the British Empire Exhibition.

Experimental work included investigations on a number of species of bamboo, lalang grass (*Imperata arundinaceae*) Merker grasss (a giant grass grown at the Serdang Experimental Plantation which gave a high yield per acre) Citronella grass (after the distillation of the essential oil) and Napier grass, grown at the Serdang Experimental Plantation.

A report on the bamboos sent to the Forest Research Institute, Dehra Dun, India, indicates that a bleached pulp of good quality can be prepared, from at least one of the bamboos, by suitable treatment. It was shown that the original samples of pulp made at the Department of Agriculture were insufficiently digested due to the inadequate nature of the plant used.

Fibre Investigations.

A bale of roselle fibre has been prepared and despatched to the Malay States Information Agency.

Several reports on samples of roselle fibre received from various sources have been made. Samples of rope made locally from this fibre and used as slings on hatches by the Railway Department have been inspected. This rope showed considerable signs of wear compared with Manila hemp rope, used in a similar manner. This was due partly to the fact that the locally manufactured roselle fibre rope was not made as satisfactorily as the Manila hemp rope.

A batch of Bowstring hemp (*Sansieveira* spp.) has been prepared for the Agriculturist for shipment to Europe.

Reports on samples of fineapple fibre have been prepared.

Power Alcohol Investigations.

Research in connection with the production of Power Alcohol has been concerned mainly with tapping experiments on Nipah Palms.

A preliminary report on the investigations has been published in the Malayan Agricultural Journal and a further report is being prepared.

An investigation of the sugar content of lalang grass, after hydrolysis, has also been carried out at the request of the Secretary of State for the Colonies on behalf of the Board of Industrial and Scientific Research.

This investigation confirmed the results obtained by the Board on samples sent for examination to England, which showed that the total "sugar" content, after hydrolysis with 0.5 per cent. of Sulphuric acid, for slightly varying times and pressure, amounted to about 20 per cent. of the weight of the dried grass. Pentoses accounted for 70 per cent. of the "sugar" content. The optimum time of digestion was found to be about 4 hours at a pressure of 10 lbs. increased at the end of 4 hours to 35 lbs. for about 10 minutes.

Soils and Fertilisers.

Ninety five samples of soil have been examined during the year. These include soils on areas for the cultivation of arghan fibre, tuba (Derris elliptica), cotton, dry padi and ragi, rubber, gutta percha, and coconuts. An investigation on the salinity of some coastal soils, in connection with Nipah Palm cultivation, has also been carried out, but the results have not led to any definite conclusion as to the correlation of salinity and suitability for Nipah cultivation, except that the palms appear to flourish best when the salinity is below 1 per cent. calculated as sodium chloride.

An investigation has been commenced in the Pot-culture house to determine the comparative nitrogen fixing values of various tropical leguminous crops and also comparative tests on the values of Perlis Phosphates, Christmas Island Phosphate and Superphosphate.

An investigation of different soils on which oil palms are growing well is in progress.

Fertilisers.

An examination of a large number of samples of phosphate from the Perlis phosphate deposits has been made and a report will be issued later. The results show considerable variation. Some samples consist of calcium phosphate, while others contain aluminium and iron phosphates.

An examination of a number of samples of phosphatic guanos from Gunong Pondok Caves, Padang Rengas, has also been made. These samples are of considerable interest and are also very variable. One feature is the comparatively high content of calcium nitrate in some of the samples.

A sample of sawdust refuse from poultry houses was examined and found to be of little manurial value.

An analysis of the ash of giant mimosa has shown that it contains 40 per cent. of calcium phosphate.

An analysis of the residue from gutta percha leaves, after the extraction of the gutta percha by mechanical treatment and treatment with water has shown that this material contains only about 1 per cent. of nitrogen and is of value only for local application in increasing the organic matter of the soil.

Feeding Stuffs for Poultry and Cattle.

The investigation of local feeding stuffs for poultry has been commenced. Samples of Mimosa, *Boga medolloa* (*Tephrosia candida*) Maple peas, and samples of prawn and small fish refuse have been examined.

The mimosa and *Boga medolla* compare favourably with clover, while the prawn and fish refuse are valuable for admixture with other feeding stuffs.

A sample of Elephant grass has also been examined to determine its value as a cattle food.

This work is being continued.

An investigation of the hydrocyanic content of lima beans has been carried out. Preliminary experiments have shown that the locally grown samples examined are satisfactory. A report on the work will be published shortly.

A sample of sago refuse has been examined with a view to its possible use as a pig food. It was found to contain a small percentage of crude fibre but the nutrient value is low.

Gutta Percha Investigations.

Investigations, which are nearly completed, are being carried out for the Forestry Department on the extraction of gutta percha from leaves of the plant. This investigation has shown that the method of grinding has a marked effect on the yield. Although the leaves can be ground excellently in an ordinary crepeing machine, it is not possible subsequently to separate the gutta satisfactorily. It has been found however that grinding with edge-runners, similar to those used in the grinding of various oil seeds and cakes, is effective.

A yield of about 2 per cent. of gutta has been obtained from fresh leaves supplied by the Forestry Department from indigenous gutta.

A sample of leaf gutta percha prepared locally has been examined and found to be of good quality in respect of the low content of non-gutta constituents.

Exhibition samples have been prepared on behalf of the Forestry Department, for the British Empire Exhibition.

Damar Resins.

An investigation of damar resins has been carried out for the Forestry Department. The results indicate that the chemical analysis has little bearing on the market valuation of the damars, which are judged chiefly on a colour basis and on the size and cleanliness of the particles. Washings and coarse and fine dust contain a certain amount of bark and dirt. A hot sieving method was adopted to remove particles of bark and dross, resulting in the production of a dark but clear block of resin. About 1 cwt of this material has been handed to the Forestry Department to determine its commercial value.

These experiments on the conversion of "dust" damars by melting have shown that the product darkens considerably which may affect its market value. It remains to be seen whether damar thus treated will command a higher market value than the fine particles of lighter colour, also whether any chemical treatment to prevent darkening can be applied.

Locally manufactured Soap.

An investigation of locally manufactured soaps has been commenced in order to determine their quality and to assist the local manufacturers with advice. Samples of palm oil soap, coconut oil soap and rubber-seed oil soap have been examined. The following raw products are being used in the manufacture of these soaps in addition to the oils and fats mentioned above :—caustic soda (sodium

hydrate) sodium carbonate, bleaching powder, sodium silicate and animal fats.

The investigation has been discontinued owing to pressure of work, but will be resumed later.

Medicinal Plants.

It has been found impossible, owing to pressure of work, to undertake a systematic investigation of various medicinal plants.

An assay of the alkaloidal content of two varieties of Datura has been carried out. The alkaloid scopolamine predominated in both specimens. The cultivation of this plant on a small scale might prove remunerative.

Desiccated Coconut.

Samples of desiccated coconut prepared under different conditions have been examined after storage and a report on the samples has been prepared for publication.

The manufacture of this product is being continued by Ban Teik Bee & Co., at Butterworth.

Miscellaneous Investigations.

Miscellaneous investigations include the following :—

Four samples of tobacco leaf for determination of nicotine content, for use as an insecticide.

Samples of a special coagulant and anti-coagulant have been examined together with rubber prepared by their use. It was found that these samples were not of special value.

The identification of a compound recommended for the prevention of "spot" disease of rubber has been carried out and a report published in the Malayan Agricultural Journal.

A specimen of Akar Sintok (Entada phaseoloides) forwarded by the Forest Research officer was found to contain a saponin. This plant is stated to be used locally for the preparation of a hair wash etc. and is also said to be used for the preparation of hair tonics in other countries. An enquiry has since been received from America for particulars and information and samples are being forwarded.

A sample of a very light wood (Alstonia spp. N. O. Apocynaceae) has been examined and found to be of little value, except possibly for local use as floats for fishing nets.

Two samples of transformer oils have been examined for the Federated Malay States Railway Department.

A sample of creped jelutong "rubber" was examined and found to contain 75.5 per cent. of "resin" and 7.5 per cent. of moisture. The results are normal for crude jelutong.

A proprietory insecticide received from the Government Entomologist was found to contain citronella oil, soap and ammonia.

At the request of the S.I.P.E.F. Agency, a sample of the non-caoutchouc constituents of latex was prepared and despatched to the Firestone Tire and Rubber Company.

Inventions.

Forty-three reports on applications for inventions have been made during the year.

Special Reports.

In connection with enquiries received from various firms, estates or individuals, reports on the following have been prepared and despatched :—

Manufacture of hydrogen.

Preparation of guttapercha.

Rubber seed oil.

Preservation of latex.

Preparation of rubber by the Spray process.

Local vegetable dyes.

Nipah palm products.

Expression of castor oil.

Manuring of rubber.

Factories for the manufacture of wet native sheet rubber.

New methods of rubber manufacture.

Concentration of latex.

Coconut oil machinery.

Publications.

The following articles have been published by members of the Chemical Division :—

1. Note on Minyak Nyatoh ... by C. D. V. Georgi, M. A. J., Vol. XI, No. 2, February, 1923.

2. Note on Kepayang Oil ... by C. D. V. Georgi, M.A.J., Vol. XI, No. 2, February 1923.

3.	The composition of Kedah and Perlis Phosphate ...	by V. R. Greenstreet, M.A.J., Vol. XI, No. 3, March, 1923.
4.	Production of Alcohol from Nipah palm ...	by B. J. Eaton and J. H. Dennett M.A.J., Vol. XI, No. 3, March, 1923.
5.	Oil cakes as feeding stuff for cattle ...	by B. J. Eaton, M.A.J., Vol. XI, No. 5, May, 1923.
6.	Candlenut oil from Aleurites Moluccana ...	by B. J. Eaton, M. A. J., Vol. XI, No. 5, May, 1923.
7.	Roselle seed oil ...	by C. D. V. Georgi, M. A. J., Vol. XI, Nos. 7–9, July—September, 1923.
8.	Sodium silicate in Soap manufacture ...	by C. D. V. Georgi, M. A. J., Vol. XI, No. 7–9, July—September, 1923.
9.	Jelutong ...	by C. J. Eaton and J. H. Dennett M.A J., Vol. XI, Nos. 7–9, July —September, 1923.
10.	Factors affecting the rate of vulcanisation of Plantation rubber ...	by R. O. Bishop, M. A. J., Vol. XI, November, 1923.
11.	Some constituents of Hevea latex ...	by W. N. C. Belgrave and R. O. Bishop, M. A. J., Vol. XI, No. 12, December, 1923.
12.	The effect of the oxides of arsenic on the rate of vulcanisation of rubber ...	by B. J. Eaton and R. O. Bishop, Journ. Soc. Chem. Ind. Vol. XLII, No. 29, July 20th, 1923.
13.	Alteration of Rate of Vulcanisation and Deterioration of Raw Rubber during storage ...	by B. J. Eaton and R. O. Bishop, Journ. Soc. Chem. Ind. Vol. XLII, No. 29, September 20th, 1923.

GENERAL.

The Agricultural Chemist was appointed a member of (1) A Committee :—

(*a*) To consider the requirements of Governments Departments for routine analytical work and research in chemistry and biochemistry, apart from rubber research, for which separate provision is being made.

(*b*) To report upon the most efficient and economical means of meeting these requirements.

(2) A committee for the Proposed Institute for Rubber Research.

The Agricultural Chemist was also appointed to represent the Governments of the S.S. and F.M.S. at the Second Pan-Pacific Science Congress held in Melbourne and Sydney in August.

Reports on the visit to Australia and on a visit to Java on the return journey from Australia are being prepared.

The Agricultural Chemist with the sanction of the Governments of the Straits Settlements and Federated Malay States also accepted an invitation to be an Advisory and Consulting Member of the Crude Rubber Committee, Rubber Division, of the American Chemical Society.

ANNUAL REPORT OF THE CHIEF AGRICULTURAL INSPECTOR FOR 1923.

By F. W. South.

I.—Staff.

THE Chief Agricultural Inspector, Federated Malay States, Mr. F. W. South, proceeded to Europe on vacation leave on May 19th and returned on December 18th, 1923. In his absence Mr. F. Birkinshaw, previously Assistant Agricultural Inspector, Perak North, acted as Chief Agricultural Inspector. Inche Mohamed Noor bin Hamzah, Senior Agricultural Assistant, Province Wellesley, was transferred from Bukit Mertajam to Taiping on May 9th to act as Assistant Agricultural Inspector, Perak North.

Mr. T. C. Nock, Assistant Agricultural Inspector, Pahang West, proceeded to England on medical leave on August 13th; he died in London on October 27th 1923. Mr. Nock was an officer with long service in the Department and his loss is deeply regretted. An account of his service is given in the Malayan Agricultural Journal Vol. XI, No. 12, December 1923. Since August 13th the Chief Agricultural Inspector himself has taken charge of Pahang West.

II.—Estates Visited.

The following table shows the total number of estates visited throughout the Federated Malay States, the Straits Settlements and Johore:—

Area.	Estates Visited.	Visited by request.	Visited more than once.	Remarks.
Province Wellesley & Penang	51	5	20	
Perak North	18	7	2	
Perak South	28	9	5	
Selangor	39	11	6	2 visited thrice
Negri Sembilan	42	11	26	—do—
Pahang West	7	—	5	
Pahang East	10	—	7	
Malacca	19	7	4	
Johore	48	13	11	
Additional Visits by C. A. I. or Acting C. A. I.	8	—	—	
Totals.	270	63	86	

The totals include several other visits by the Chief Agricultural Inspector made in company with the Assistant Agricultural Inspector for the area in which each estate is, and consequently entered under the heading of that area. The total of 270 estates visited in 1923 compares with a total of 326 in 1922. The majority of the visits were routine inspections for pests and diseases, or made at the request of Managers to advise on treatment of some particular disease or pest. A certain proportion were, however, in connection with new crops or crops other than rubber, while eleven in Johore were paid at the request of the Rubber Restriction Committee.

III.—Diseases and Pests of Rubber.

1. *Stem Diseases.*

Pink Disease (*Corticium salmonicolor*, B. & Br.) :—This disease was newly reported from 24 estates in the Federated Malay States, the Colony and Johore, making a total of 355 estates from which it has been reported. In all 1,265 notices were served requiring the treatment of this disease. Failure to comply with the notices led to 144 prosecutions, of these 131 persons were convicted and fined sums amounting to $1,678.00 with $33.75 costs.

This disease received careful attention on practically all European managed estates. In all districts where the disease is prevalent such estates maintain a pest gang to carry out routine treatment of infected trees.

During a period of wet weather in December the disease became somewhat more prevalent in part of Ulu Selangor district than it had been at any other time in the year. This was due to the illness of the Inspecting Officer and the fact that no other officer was available to replace him.

It is expected that the disease will quickly be controlled effectively in Ulu Selangor, as soon as the officer there is able to return to work, since he has done very effective work in that district for the greater part of the year.

It is pleasant to be able to record that, as a result of demonstrations given by the departmental officers and of the distribution of pamphlets in Asiatic languages, small holders in the badly infected districts are beginning to realise the necessity for treating this disease regularly and thoroughly.

The disease appeared for the first time in the Sitiawan area, early in the year. The cases were sporadic and not numerous. After they had been treated no fresh outbreaks were reported or seen. (Malayan Agricultural Journal Vol. XII, No. 2 pp. 32, 39, and 44).

Mistletoe (*Elytranthe globosa* and *Loranthus pentandrus*) Dalu api or Daun api api (M) :—In March a local firm of Estate Agents enquired of the Department as to the possibility of various species of local mistletoe becoming wide spread on rubber and doing

considerable damage to the trees. Local mistletoes were reported by them to be giving much trouble on certain estates, principally in Malacca. The Assistant Agricultural Inspectors made local collections of these plants and observations on their prevalence on different hosts. These collections were sent to the Assistant Economic Botanist who examined and identified them. From the records made it appears that only the two species mentioned above are at all common on rubber and that, on the whole, rubber trees are not severely attacked by these parasitic plants which are far commoner on fruit trees and jungle trees. When attacked trees are found they usually receive adequate treatment on estates and treatment is advised and enforced on small holdings. Other species of mistletoe will be referred to later. (Malayan Agricultural Journal Vol. XII, No. 2 pp. 36, 40 and 47).

2. *Bark Diseases.*

Mouldy Rot. (*Sphaeronema fimbriatum* E. & H.) This disease was newly reported from 3 estates in Perak North, 2 in Selangor, 5 in Negri Sembilan and 3 in Johore, making a total of 87 estates from which the disease has been reported. In all 3,596 notices requiring its treatment and control were served ; as a result 342 persons were prosecuted for failure to comply with the instructions given, of these 240 were convicted and fined sums amounting to $1867.00 with $75 75 costs.

During the year the disease spread very considerably. In Perak North it appeared early in December in an area of small holdings around Bruas between 1,000 and 2,000 acres in extent. It also appeared later in the month on some small holdings in the mukim of Sungei Tinggi in Larut District. Early in the year the area originally infected near Padang Rengas became somewhat extended, as a certain number of additional holdings were affected. Only 4 estates in Perak have so far been attacked and on these the disease has been brought under complete control.

In Selangor the disease appeared in one small holding in the Labu Malay Reservation and in one or two holdings at Beranang both being near the Negri Sembilan border. Prompt treatment prevented any considerable spread from these centres. In November, however, after a period of heavy rain a serious outbreak of considerable extent occurred in Batu and Setapak mukims near Kuala Lumpur. This is mainly confined to small holdings, only 2 estates being infected.

In Malacca the disease spread steadily throughout the year, so that at the close a large portion of the Settlement was infected to a greater or less degree. The disease is still entirely confined to small holdings, with the exception of the one estate on which it first appeared in Malacca.

In Johore the disease spread considerably in Batu Pahat district. Throughout the year it was very prevalent in Muar district which has now been infected for at least four years.

In nearly all centres the prevalence of the disease has depended considerably on the weather, except in the Muar district of Johore where the general condition of the holdings themselves is such as to maintain a degree of moisture in the atmosphere, that enables the fungus to grow actively at all seasons. The same statement applies to certain of the low-lying mukims on the Malacca side of the Johore boundary.

Everywhere the disease has received the persistent attention of the inspecting officers, while in the more seriously infected centres, or where new outbreaks have occurred, special efforts have been made to impose an adequate control on the disease and staffs of officers have been temporarily increased when necessary.

The freedom from attack of most estates in the more recently infected areas, such as the Settlement of Malacca, and the mukims around Kuala Lumpur, is due to the fact that the majority of such estates employ a settled labour force and do not engage casual coolies locally, so that the coolies do not come in contact with infected trees. There is no doubt whatever that the disease is mainly conveyed to new areas by human agency. A contributing factor to freedom from the disease is the much better opportunity for healthy growth afforded to individual trees on well run estates.

The disease is worst in the small and often neglected holdings of poor and uneducated owners. Even with restriction in force such owners are unwilling to stop tapping for the period of three weeks or a month, necessary for the proper treatment of the disease. Moreover, if infected trees are painted regularly with a disinfectant at intervals of about a week, the fungus, though not eradicated, is prevented from doing serious damage to the renewing bark. Small owners are becoming aware of this and are, therefore, all the more disinclined to stop tapping, though willing to use a disinfectant fairly regularly. In some places holdings owned by absentee Malays are leased to Chinese who have no interest in the alien trees, and merely desire to obtain as easily as possible all the rubber they are allowed to export. In other places Malay owners employ Chinese tappers on a profit sharing basis, with the same result.

Such circumstances often render the enforcement of control measures difficult at first. The inspecting officers have, however, devoted considerable attention to teaching small holders the danger of the disease and the proper measures for its treatment and control. Numerous field demonstrations have been given and this educational work is meeting, on the whole, with a satisfactory measure of success. In many of the infected areas the diseased trees are now regularly painted, with the result that, though the disease is not eradicated, it is kept under such efficient control that only a certain number of cases occur in wet weather, while in dry weather it may entirely disappear. Legal enforcement of control is not neglected when necessary, but it is hoped that in course of time educative methods will teach the more ignorant small holders that they are responsible for keeping their holdings free from diseases and that to do so is in their own interest.

The Department has given much prominence to this disease, because it is considered that it must eventually spread to nearly all those parts of British Malaya where rubber is to be found growing under poor conditions of cultivation. Such areas will serve as sources of infection for better tended properties. It is, therefore, desirable that as many rubber planters as possible of all nationalities should be acquainted with the disease, the damage it can cause, and the ease and comparative cheapness with which it can be effectively controlled. (Malayan Agricultural Journal, Vol. XII, No. 2, pp. 32, 39 and 44).

Black Stripe (*Phytophthora* sp.):—This disease was newly reported from 5 estates in Negri Sembilan, 1 in Pahang and 1 in Johore, making a total of 122 reports in all. There were 39 notices served requiring its treatment, but no prosecutions were necessary. On the whole the disease was not much in evidence, though it is still bad at Jelebu and Pertang in Negri Sembilan. (Malayan Agricultural Journal, Vol. XII, No. 2, pp. 33, 40 and 46).

Cyphella sp.:—During wet weather in January reports were received from 5 or 6 estates in Selangor of attacks of this fungus of which the identity is uncertain. It was sometimes mistaken for Mouldy Rot disease. Only on one estate did it do damage. An account of it is given in the Malayan Agricultural Journal, Vol. XII, No. 2, p. 32. The fungus shows indications of becoming somewhat more virulent on rubber and should be watched.

3. *Root Diseases.*

Fomes lignosus, Klotsch:—This disease is still fairly prevalent on young clearings from which the timber has not been removed. In Johore it has been noticed that young rubber interplanted with tapioca invariably shows a high percentage of infection; the fungus has been found growing strongly on the tapioca tubers.

Both in Johore and elsewhere instances have been found where this disease has done serious damage to mature fields of rubber owing to the neglect of it when the fields were young. (Malayan Agricultural Journal, Vol. XII, No. 2, p. 40).

Other Root Diseases:—*Fomes pseudoferreus*, Wakef., *Ustulina zonata*, (Leo.) Sac., and Brown root disease have been found fairly commonly all over the country.

There were 26 notices issued for the treatment of root diseases but no prosecutions resulted.

Other diseases of rubber such as patch canker, die-back for which 36 notices were issued, brown bast and *Sphaerostilbe repens* were recorded but require no comment. Sun-burn wounds on thin renewing bark, followed by the development of a partly parasitic mould, consisting largely of the fungus Gloeosporium, were occasionally recorded in dry weather.

Among pests white ants (*Coptotermes gastroï*, Wasm.) were fairly numerous, while pig and deer occasionally do considerable damage.

4. *General Sanitation.*

The removal of dead rubber stumps and timber from small holdings has been enforced throughout the year. In all 573 notices were served for this purpose; 39 persons who failed to carry out the instructions were prosecuted; and 34 were convicted and fined sums amounting to $273.00 and $15.25 costs.

On account of extremely bad tapping, rendering the trees liable to attacks of pests and diseases, 191 notices were served. Four persons were prosecuted, convicted and fined a total of $28.00 with $3.00 costs.

IV.—Diseases and Pests of Coconuts.

1. *Diseases.*

A somewhat serious disease of coconut palms was discovered at Benut on the West coast of Johore at the end of the year, by the Inspector of Agriculture. His account is as follows:—

> "Affected trees showed a gradual withering of the fronds commencing from the tips. The outer cycle being usually the first affected. The withering continued slowly downwards, and the frond eventually broke from the trunk or collapsed and hung down from the point of attachment. The fruit in all stages dropped to the ground as the head became invaded, the cabbage being small and badly formed. The disease appears to be infectious as attacked trees are usually in groups.
>
> "Growers state that trees have been affected in the same way during previous years, but the damage done has never been so severe as in the present outbreak. They stated further that the disease was usually observed during the rainy weather following a period of drought, and that at such times the soil water, was very alkaline, and water in wells was not fit for use.
>
> "An investigation of diseased material did not disclose the presence of a causative organism. Instructions were given that dead and diseased trees should be destroyed by fire."

The matter was referred for further investigation to the Mycological Division of this Department.

A few cases of bud-rot and leaf-break were reported from Pahang East.

2. *Pests.*

Beetles.—Black beetle (*Oryctes rhinoceros*, L.) and Red Stripe weevil (*Rhyncophorus schach*, Oliv.):—The black beetle has continued to be fairly generally present everywhere. The red stripe weevil is

not commonly met with in Province Wellesley, Pahang or parts of Negri Sembilan.

The routine work of enforcing the destruction of all dead and decaying palms, village rubbish heaps, heaps of manure near cattle sheds and other accumulations of decaying vegetable matter, liable to serve as breeding places for these insects, has received regular attention throughout the year. In all 3,747 notices were served for this purpose. For failure to comply with instructions 281 persons were prosecuted ; of these 245 were convicted and fined sums amounting to $1,080.00 with $108.50 costs.

Although good work has been done and much rubbish has been destroyed, such accumulations are always liable to recur. Often this is due to casual neglect or forgetfulness on the part of persons concerned. In parts of Kinta, where the black beetle has been much in evidence, new breeding grounds are always being formed. This is because coconut palms on mining land are continually being killed by deposits of slime from new mines, or by neglect, and also because there are numerous cattle owners who are always accumulating manure heaps. In the Klang and Kuala Selangor districts of Selangor control of the black beetle is retarded by the Tamil cattle owners, who continuously accumulate manure and take every possible means to hide it when ordered to destroy it. All attempts to establish a system of disposing of the manure in pits, so that it could be used on Sireh plantations and yet remain free from beetle grubs, have failed. The Assistant Agricultural Inspector, Selangor, remarks that breeding grounds are often overlooked. He found, when visiting Port Swettenham on account of a bad outbreak of beetles in the middle of the year, that many of the heaps of grass cut by Sanitary Board coolies were simply the covers to heaps of decaying cattle-manure from which numerous grubs were extracted.

The red stripe weevil is generally most common in places where sago palms are numerous. The Inspector of Agriculture, Johore, remarks that the sago industry carried on along the banks of the Batu Pahat river is responsible for the encouragement of this pest to a very large degree, as it is not possible to supervise the destruction of the sago palm stumps on the overgrown marshy banks of the river.

The control of these two well known pests will require continual attention from inspecting officers. With a view to lightening this work in time, lectures and demonstrations are being given in some districts to teach small holders the connection between the grubs of these insects and the beetles into which they develop and to impress on small holders the consequent necessity for destroying all accumulations of decaying matter in which the beetles can breed. The mature beetles themselves and the damage they do to the coconut palms are well known to people of all nationalities, but many uneducated Asiatics are ignorant of their connection with the grubs, while some will not even believe it when told. (Malayan Agricultural Journal Vol XII, No. 2, pp. 33, 40 and 46.)

In Pahang East one man was fined $10/- for felling coconut trees without permission under the Coconut Palms Preservation Enactment

The existence of this Enactment in Johore is not well known among growers of coconuts, consequently palms have been indiscriminately destroyed. Steps are now being taken to check this destruction and make known the procedure required by the Enactment.

Artona (*Brachartona*) *catoxantha*, Hamp:—This appeared in Province Wellesley at Permatang Pauh and Permatang Ara in February and at Permatang To Jaya in March. The pest appeared in the first two places 5 or 6 years ago, according to local report, and was recorded at Permatang To Jaya in 1921. In the second quarter of the year outbreaks, not of a serious extent, were recorded at Sungei Kota, Sungei Megat Aris and Kuala Kuran in Krian district. In February a somewhat extensive and severe attack was reported on coconut palms around Batu Gajah town and in May a slight outbreak occurred at Menglembu in Kinta on the same area attacked three year ago. In Selangor there was an outbreak early in the year at Sungei Ayer Tawar (Sabak Bernam district) and later in the year at Sepang. In Raub district of Pahang an outbreak was recorded at Dong in January and in Pekan district at Lepar in May.

Nearly all these attacks were ultimately controlled by their natural enemies, of which the fungus *Botrytis* sp. appeared to be the most important in Province Wellesley and Krian, while a Tachinid fly was the prominent parasite near Batu Gajah.

A small area of trees at Batu Gajah was sprayed with water by the Ipoh Fire Brigade. By this means thousands of caterpillars were knocked off the high trees and subsequently killed. These trees were freer than others from the caterpillars in the next generation of the pest. Unfortunately difficulties in obtaining water prevented the use of the fire engine throughout the infected area.

The pest is difficult to control effectively, partly on account of the difficulty of reaching the tops of full grown palms, and partly because it is necessary to avoid, as far as possible, the destruction, along with the pest itself, of too high a proportion of the insects which in normal circumstances keep the pest under control. (Malayan Agricultural Journal, Vol. XII, No. 2, pp. 34, 41 and 46.)

Other pests recorded on coconuts during the year were nettle-caterpillars (*Setora nitens*, Walk. or a related species) in Penang and Province Wellesley and in Kuala Kangsar district, skippers (mostly *Hidari irava*, More), bagworms (*Mahasena* sp.), the "greater" and the "lesser" coconut spike moth (*Tirathaba* sp. near *trichogramma*, Meyr. and *Batrachedra arenesella*. Walk.), and white flies (*Aleurodicus destructor*, Mask.) from various parts of the country.

Squirrels and rats did a certain amount of damage as usual. In Krian locally made traps for squirrels were in use and gave good results.

V.—Pests of Padi.

Nymphula depunctalis, Gn.:—This insect occurred on experimental nurseries in Province Wellesley and retarded the growth o-

the padi considerably, but eventually disappeared. It was also recorded from three localities in Larut district. Spraying with a solution of tuba root much reduced the numbers of the insects. (Malayan Agricultural Journal, Vol. XII, No. 2, p. 47).

Stem borers:—As the padi crop generally was late these insects were not much in evidence by the end of the year. In Province Wellesley arrangements have been made strictly to enforce the Ordinance protecting the bird known to Malays as ruak ruak. (Malayan Agricultural Journal, Vol. XII, No. 2, p. 35).

Podops coarctata, F. Bena Kura or Kutu Bruang (M):—This pest did some damage in the localities of Trong, Lambor, Bruas and Bota in Perak North. Had the presence of the pest been reported to the District Officers earlier, the damage could have been partly prevented. The same pest did some damage to the 1922-23 crop at Bandar in Perak South owing to lack of water. It is recorded as doing damage in various parts of Johore where the dry condition of the padi fields due to lack of rain rendered control work difficult.

Nephotettix bipunctatus, F.:—This pest did a little damage at Talang Test Station, Lambor, Ulu Selama and Bukit Gantang in Perak North. Spraying with tuba root solution proved effective.

Leptocorisa spp. Chenanggong, Pianggang (M):—The various species of this insect damaged padi at Chemor in Perak, at Johol and Inas in Negri Sembilan somewhat severely, and in the Kota Tinggi district of Johore. (Malayan Agricultural Journal, Vol. XII, No. 2, p. 47).

Mole crickets. (*Gryllotalpa* sp.) Sesorok, Sorok sorok (M):—These did some damage at Bandar in Perak South to the 1922-23 crops owing to the lack of water. They also did damage to newly planted out seedlings at Sungei Mati in the Muar district of Johore. Here also the fields attacked were all very dry.

Rats. These have as usual done considerable damage everywhere. Distribution of barium carbonate at cost price has been continued and in the Colony rat traps have been on sale at cost price.

In Johore barium carbonate was supplied early in the season to all padi growing centres, while a circular on rat destruction in Jawi was widely distributed. Trapping and hunting were practised in a portion of the Muar district and head money was paid by the Penghulu for rats destroyed.

The use of barium carbonate is becoming popular in some centres where its effect has been obvious, more especially where many of the rats killed have subsequently been found. When the dead rats are not found, the Malay rice-grower is liable not to believe in the effect of the poison. A little care in preparing baits has a considerable effect on the results. Instruction in the methods of controlling rats will be continued. (Malayan Agricultural Journal, Vol. XII, No. 2, p. 35).

On the whole, apart from rats, pests have done but little damage to padi during 1923. Far more damage has been done by rain and floods.

VI.—Lalang and Blukar.

As owners of small holdings became once more comparatively prosperous, it was decided that the inspecting officers should take steps to ensure that rubber and coconut holdings should again be cleared from the presence of excessive undergrowth and of lalang. Many holdings had been neglected in this respect during the slump, owing to the poverty of owners. In consequence the growth of the trees had been retarded. Furthermore great encouragement is given to the spread of certain diseases by the moist conditions of environment on such holdings. The work met with a certain measure of success and conditions on small holdings are improving, though it will be some time before they become entirely satisfactory.

The notices served requiring the cleaning of small holdings totalled 6,311. For neglect of instructions 630 persons were prosecuted; 549 were convicted and fined sums amounting to $2,244/- with $153.25 costs. (Malayan Agricultural Journal, Vol. XII, No. 2, pp. 35, 41 and 47).

VII.—Water Hyacinth (*Eichhornia crassipes*, Solms.).

In Province Wellesley this pest is present in important quantities only in the waterways of the Sungei Acheh district and in the Province-Perak boundary drain. The Public Works Department cleared the drains in Sungei Acheh district and the Executive Engineer, Krian, was asked to clear the few bad patches in the boundary drain.

In Perak North only three coolies were employed on this work during the year. On completing the work around Taiping they cleaned the Perak River during August and September. In Krian the two rivers, Sungei Gedong and Sungei Samagaga, and all State Land were cleaned in October and November. The gang returned to Taiping on December 9th. It has been decided to pay off these coolies as soon as the destruction of this plant around Taiping has been completed, and to re-employ them only when the Perak River again requires cleaning, or when there is any special work needing attention. During the year Water Hyacinth on privately owned land and in irrigation canals and drains has been satisfactorily destroyed.

In Perak South during the first half of the year a considerable amount of work in destroying this pest was done on the Perak River and its tributaries. The Sungei Rambutan and areas around Bandar were all cleaned up as well as areas at Kampar, Kuala Dipang and Malim Nawar. Work has now been stopped, but a list of places where the weed is growing is kept and these will receive attention if and when they require it.

In Selangor, as in previous years, a certain amount of attention to this pest has been found necessary in Ulu Selangor, Kuala Selangor and Kuala Lumpur Districts, both on State and on alienated land.

In Negri Sembilan the weed is still found occasionally and destroyed where found. The number of places where it occurs is very much less than formerly. Areas in which it was formerly plentiful are now free.

In Johore the control of this pest is under the various Land Offices throughout the State and its presence whenever noted is reported. It is largely cultivated by pig breeders; it has been noted in Government water ways in Batu Pahat district and has been found in a padi field at Sungei Mati.

The total expenditure on the destruction of Water Hyacinth in the Federated Malay States in 1923 was $1,810.72 from a vote of $6,350.00. This indicates that the pest is well under control. In Negri Sembilan 27 notices were served requiring its removal. Five persons were fined a total of $18 00 for harbouring this pest. (Malayan Agricultural Journal, Vol. XII, No. 2, pp. 36, 42 and 46).

VIII.—Pests and Diseases of Other Crops.

Mistletoes, Species of *Loranthus* and allied genera. Dalu Api, Daun api api, Dalu Gajah (M) :—These parasitic plants are plentiful on fruit and shade trees as well as on jungle trees of secondary growth. Certain species occur at times on rubber as has been recorded above. Their removal when found on cultivated plants is now insisted upon, as they are a pest within the meaning of the Agricultural Pests Enactment.

A collection of the various species commonly found has been made and sent to the Assistant Botanist with notes on distribution and host plants. The result of his investigation regarding the geographical distribution of the species as well as their distribution on various host plants is given in the Malayan Agricultural Journal Vol. XII, No. 3, p. 64.

In Selangor and Negri Sembilan 243 notices were served requiring the destruction of species of Mistletoe. Eighteen persons who failed to comply were prosecuted; fifteen were convicted and fined sums totaling $114.00 and $6.75 costs. (Malayan Agricultural Journal XII, No. 2 pp. 36 and 47.)

Giant snail (*Achatina fulica*) :—An interesting account of this animal is given by Jarrett in his paper "The Occurrence of the Snail *Achatina fulica* in Malaya," *Singapore Naturalist* No. 2, April 1923, p. 73. The Assistant Agricultural Inspector, Penang and Province Wellesley, reports that it has spread to a certain extent to the east of the coastal road leading from Butterworth to the north. It is also present in the compounds of houses round the District Hospital where the land is wet and low-lying.

Shallow trenches filled with saw-dust, as recommended by the Assistant Agricultural Inspector, have proved an efficient protection to a garden against invasion from outside. Lime is said to have been an effective protection in another case, but this is still uncertain. (Malayan Agricultural Journal, Vol. XII, No. 2, p. 36.)

Mango Pests:—The branch borer (*Rhytidodera simulans*, White.) was found to be present on about 26,420 mango trees in Krian district. The majority of the trees in this district were far from healthy. The Government Entomologist advised that all infected parts should be cut off well below the observed point of infection and burnt; and that cut surfaces should be tarred. Considerable improvement is shown in some localities.

The same pest was found on a plantation of young grafted mangoes and treated in the same way. On this plantation a fruit fly was also found. The fruits are now enclosed in cloth bags. Mealy bugs are recorded on mangoes at Tanjong Rambutan, these were treated. The branch borer is present on the majority of mango trees all over the country. (Malayan Agricultural Journal, Vol. XII, No. 2, p. 42).

Coffee:—Plants of Liberian coffee about 18 months old on an estate in Perak South were attacked by the green scale insect (*Lecanium viride*, Gr.). They were successfully treated by spraying with a rosin wash.

Bananas:—Leaf beetles, *Autoserica* sp. and *Adoretus compressus* were recorded on bananas around Taiping. The insects were very active after sunset, but were never seen during the day. They live in the soil. The leaf roller (*Erionota thrax*, L.) was common everywhere as usual. A weevil identified as *Cosmopolites sordidus*, Germ. was found attacking bananas at Muar in Johore. Infected plants were destroyed immediately and no further reports of damage have been received.

Various minor pests and diseases of different plants have been collected during the year and sent to the Entomologist or the Mycologist for identification and record.

IX.—Notes on General Agriculture.

1. Rubber.

Throughout the year restriction of output combined with an increase in demand maintained the price of rubber at a figure providing a margin of profit on practically all estates; at the same time sufficient money was available to provide for proper attention to works of maintenance such as drainage, weeding and sanitation. The majority of small holdings were regularly tapped, often somewhat severely, to obtain the full output allowed for exportation.

The increase in price was not such as to cause any reversion to former extravagance in administration of estates and the year's

experience has done much to standardise prices and methods of work. This will be to the benefit of the industry in maintaining expenditure at an economical level, even if the market price of the commodity should rise.

Conservative systems of tapping are now the rule on all estates, one cut on $\frac{1}{2}$, $\frac{1}{3}$ or $\frac{1}{4}$ of the tree tapped every other day are common, while the A. B. C. system of tapping and resting a given area periodically is gaining in popularity. On small holdings tapping is still usually on a V or $\frac{1}{2}$ cut daily, in places even twice a day. Where daily tapping would result in production of rubber in excess of the amount allowed for export, were it continued for the whole of each quarter, it is often found that the trees are tapped for two months and rested for one.

Excessive tapping, as frequently as twice daily, sometimes combined with the use of ladders to give access to tappable bark, is most common on small holdings in flat areas near the coast, where the water table is high and conditions are not suitable for the growth of rubber. In such holdings bark renewal is very slow and severe wounding is common. Consequently the severe systems of tapping in such cases can be taken as a good indication that these holdings could not on a reasonable system of tapping obtain their standard production. In localities where the growth is better there is another explanation of severe tapping. The owner of a holding of good trees will sometimes lease one or two more holdings and tap only the two leased holdings, while resting his own, to obtain the full amount of rubber for export allowed him on all three holdings.

The necessity for preventing loss of valuable surface soil from clean cleared slopes, subject in this country to heavy rains, is now widely recognised by planters. Systems of catchment pits, terracing and the use of cover crops or plants such as Citronella and Lemon grass are in common vogue on estates. Under older rubber, where soil covers will not grow well, the growth of strips of grass and low weeds is often permitted.

2. *Coconuts.*

The price of the best quality copra on the Singapore Market rose from $10.30 a pikul at the beginning of the year to $13.10 in April. It fell to $9.75 in July and rose again to $12.14 in December. The average price for the year was $11.30 which was better by about $1.00 than the average price in 1922. Local market prices for the produce of small holdings varied at different places from $7 to $11.50 per pikul. On the coast the price of nuts varied from 2 to 6 cents each and inland it ranged from 5 to 8 cents each.

The Commissioner of Trade and Customs has kindly supplied the following figures showing the export of copra from the Federated Malay States.

State	Quantity in Pikuls			Value in Dollars.		
	1921	1922	1923	1921	1922	1023.
Perak	436,054	698,934	588,771	5,416,972	6,624,465	5,788,380
Selangor	163,516	214,266	218,911	2,054,315	1,982,730	2,239,237
N. Sembilan	1,501	5,970	8,257	21,088	54,617	85,401
Pahang	7,269	9,449	8,089	77,326	83,753	77,683
	608,340	928,619	824,028	7,569,701	8,745,565	8,190.701

There was a decrease in production of 404,591 pikuls as compared with that in 1922. This occurred almost entirely in Perak. The explanation probably is that only a comparatively very small area of young trees came into bearing in that State, while from all accounts the crop from existing areas was, for some reason not yet understood, considerably below that obtained in 1922. The cultivated area in bearing will increase in the next 2 or 3 years and crops may be expected to improve. The outlook for the crop is, therefore, satisfactory as the price obtainable seems likely to remain steady.

The favourable condition of the coconut and copra market during the last few years has been a satisfactory feature of a difficult period. It is, therefore, the more regrettable that the rush for rubber and large profits induced owners, even as recently as 1916 and 1917, to destroy so many of their palms. The fine growth and yield of these trees on many of the coastal lands of this Peninsula, the ease with which they can be cultivated and the steady market for their produce render this industry particularly suitable for Malay small holders. It is greatly hoped that co-operative methods of marketing can be introduced in the near future for the benefit of proprietors of small holdings and that the considerable profits which they now enjoy may be increased thereby.

One large mill in Singapore is carrying on the manufacture of coconut oil and copra cake. It is understood that it is difficult to dispose of the oil, but that cake finds a ready sale in Australia. The manufacture of dessicated coconut at Butterworth appears to be thriving; the plant in the one factory in operation is being increased. The price of dessicated coconut products is fair.

3. *Padi.*

A very satisfactory crop of Padi was reaped in Penang and Province Wellesley for the season 1922–23, though some damage was done by excess of water in the fields at harvest.

In Perak North the crop was only an average one or slightly below the average. Good weather at harvest enabled it to be reaped with very little loss of grain, but a drought early in the season, while the plants were in the nurseries or newly planted out, followed by

heavy rains later, adversely affected the growing plants. In Perak South the crop was satisfactory.

In Selangor it was not particularly good mainly owing to unfavourable weather conditions The small areas in Selangor, frequently silted or otherwise unsuitable, naturally fail to yield well. The best yield recorded was 300 gantangs per acre from 980 acres in Ulu Langat and 100 acres at Jeram. Dry padi on 1,000 acres at Jeram yielded 200 gantangs per acre.

In the West of Pahang the crop was normal, but in Pahang East it was considerably above the average for the East coast.

In Negri Sembilan the crop in those districts where planting was late was better than that in the districts planted earlier, where it was poor on account of the heavy rains in the ripening and harvest seasons. It seems that in some districts the padi season requires altering to a different part of the year. At present the planting often falls in the dry season and the harvest during the wet weather.

In Malacca the harvest for the season 1922-23 was a fair average. Unsuitable weather conditions had a prejudicial effect on the growing crop in 1922. Later, however, conditions improved and the crop was considerably better than was at first expected.

In Johore the crop was unsatisfactory owing to the extensive damage done by rats.

In Penang and Province Wellesley and in Perak planting was much delayed by dry weather. When the rain eventually came it was heavy and persistent and did considerable damage to nurseries and newly planted fields. Eventually, however, the padi grew well and a fairly average crop is expected in most places, unless rain falls again at harvest.

In Selangor a poor crop was expected owing to damage by rain.

In Negri Sembilan and Malacca, as in the north, planting has been much delayed by dry weather. This has not, however, had a bad effect up to the end of the year and good crops are expected. In Negri Sembilan several concrete dams were constructed to control irrigation in Rembau district in place of the former temporary dams. As the Malays neglected to remove the planks promptly in times of heavy rain, floods have in several cases eaten a path through the banks, thus making the dams useless.

In Johore planting was very late and the padi was so young that no forecast of the crop could be given at the end of the year. Hill padi along the west coast, planted by Bugis among young coconuts, suffers much from the ravages of wild pig, rats and birds and the yields are very poor, never exceeding 200 gantangs per jalar ($^1/_5$ acre), while the average is much below this figure.

In Pahang East the crop for 1923–24 was almost entirely destroyed by floods. A small yield may be obtained from Pekan and Pahang Tua mukims, but elsewhere there is not sufficient to supply seed for the next planting.

It is hoped that the draining and bunding of the Bagan Nakhoda Umar area in Selangor will be completed next year and that 20,000 acres of land will thus be much improved.

4. *Fruit.*

The mid-year season in 1923 was good generally, durians, mangosteens, rambutans and pulasans being plentiful and cheap. At the end of the year there was another good season in Penang, Province Wellesley and the North of Perak with fair crops in some other districts.

The pineapple canning industry at Klang has been very quiet during the year, the price offered for fruit was as low as 60 cents per 100 in the main harvest, but rose to $3.00 per hundred at the end of the year.

Four factories are still operating in Johore and during the season were kept plentifully supplied with fruit the price of which ranged from $3 to $5/- per 100. The industry is gradually increasing. One factory is now producing pulped fruit from small pineapples for jam making in addition to canned fruit.

In Singapore this industry has also been thriving and the price of the canned fruit has been maintained at a good level. The price paid by the canners for the fruit is, however, not very remunerative to the growers.

A small orchard of grafted mangoes imported from India was planted in 1920 at Batu Gajah. The trees produced some excellent fruit towards the close of the year.

The orchard on an estate in Perak South, planted largely with imported varieties of grafted citrus fruits from Australia, is doing well. The trees are still too young to yield, but are growing well.

A Malay in Krian has a small but successful orchard of pomegranates. The trees yield well and the best fruits sell for 30 cents each in Penang, while smaller fruits sell locally at 20 cents each.

The Assistant Agricultural Inspector, Perak North, calls attention to the desirability of distributing trees of *Mangifera odorata*, Kweeni (M), of which there are a few trees in two mukims in Krian. The fruit is popular and sells for 10-12 cents each. He also refers to the general occurrence of *Garcinia atroviridis*, Assam Gelugor (M), in Perak North and the general use of the fruit by Malays in curry after it has been dried in the sun for about a week.

A few seedlings of the Brazil Nut tree have been distributed by the Assistant Agricultural Inspectors and arrangements have been made to distribute several more as they become available.

5. *Other Crops.*

African Oil Palm (*Elaeis guineensis*) :—At present only a few estates have actually been opened for this cultivation; only one is yet producing, but is believed to be making a good quality oil commanding a good price. A few of the others have increased their planted area. There have been one or two applications for land for planting this crop.

Roselle (*Hibiscus sabdariffa, var altissima*) :—One estate in Perak is growing this plant and making a profit from the sale of rope. A few other estates have small areas of it. It has not attracted much attention among Malay small holders. Experience appears to show that it is not a crop that can be profitably cultivated in small plots. It needs too much care in cultivation and subsequently in the preparation of the fibre to warrant cultivation in kampongs on a very sma l scale.

Cloves and Nutmegs :— Measures are under consideration with a view to resuscitating these industries in Penang. If co-operative methods of marketing were adopted by the Chinese growers their profits would be increased and interest in the cultivation of these plants would be renewed. Seeds of these plants have been distributed in a few places in the Federated Malay States, m stly in Negri Sembilan.

Patchouli (*Pogostemon patchouli*) :—The distillation of Patchouli oil in Singapore is being carried on at present by only one distiller who revived the industry in 1919. The leaves used by him are obtained from plants grown in Sumatra by growers who are controlled by the distiller. The value of the oil has dropped considerably during the year and is now only about $8/- per lb.

At the present time there appears to be considerable competition from a grower and distiller in Johore where the area under cultivation is slowly increasing.

Tapioca (*Manihot utilissima*) :—This crop is still grown extensively on young rubber clearings by Chinese in Johore, more especially in the north where several large factories are operating.

Sago (*Metroxylon sagu*) :—A fairly large industry for the preparation of sago flour is in existence along the banks of the Batu Pahat river in Johore. Only one factory is manufacturing commercial sago; mostly the product is prepared by primitive methods and is sent to Singapore for refining.

Tuba (*Derris elliptica*, Beth.) :—A Japanese estate on the Johore river is cultivating this plant on a large scale and is putting a root extract on the market.

Some interest has been shewn in the subject of cattle breeding and fodder grasses during the year and this Department is rendering what assistance is possible.

X.—Instruction.

1. As stated in last year's report the first year's results of experiments at the Padi Experiment Station, Malacca, were disappointing. During 1923 development work was continued, an additional area of land was acquired, ploughed and harrowed with a tractor. The station now contains an area of 23 acres. An area of 18 acres was prepared and planted with pure strains of padi from Krian and with a few well known Malacca varieties from which it is intended to select pure strains. The growth during the year was somewhat uneven. This is to be expected where new land is opened for padi. There is no reason why this Experiment Station should not in time prove as successful as that established some years ago at Titi Serong in Krian. An ample water supply under fairly satisfactory control has now been secured.

2. Testing stations for selected strains of Krian padis were established at Permatang To' Jaya in Province Wellesley and at Talang in Kuala Kangsar district. Eight strains were grown in Province Wellesley. These gave satisfactory results, the yields being carefully recorded. The results at Talang were also satisfactory. The work is being continued at both stations. It is hoped to establish one or two more such stations in other localities during 1924.

3. Manurial experiments for padi were started in 1923 in Province Wellesley and at Talang in Kuala Kangsar district. The object is to find suitable manure mixtures to replace the local bat guanos which vary greatly in manurial value and are sold at a high price. On the plots in Province Wellesley one pure strain of padi was sown. No manure was applied, as it is first necessary to test the variations in the soil of these plots by recording the yield on each. At Talang also one pure strain was planted and various manures were applied to the plots. The results will not be fully reliable until after the yields on the various plots have been recorded for several seasons.

4. Distributions of seed of various selected strains of Krian padi, likely to be suitable to different localities, were made to a number of growers in 1922 in various States. A summary of the results of these was given by Mr. F. Birkinshaw in the Malayan Agricultural Journal, Vol. XI, p. 335. Distribution was repeated and extended in 1923 and in several places the crops resulting promise to be in excess of those obtained from local seed. The work has already met with considerable success in Perak and in parts of Malacca and Negri Sembilan and it seems that before long certain strains will be recognised as being the best for certain given localities and as superior to local unselected seed. Experience in places has emphasised the need for proper control of the distribution of selected seed, as pointed out in the article referred to above; without such control lasting results would be difficult or impossible to obtain and

much, if not all, of the selected seed would be wasted in small plots of insufficient size and rapidly become merged with the local varieties.

5. Experiments were conducted during the year on two plots of land near Taiping and on one near Batu Gajah to test the use of various leguminous crops in restoring the fertility of reslimed mining land, thus rendering it suitable for padi. The plots were kindly lent by Mining Companies working with dredges. The experiments have shown so far that the following plants are best able to grow satisfactorily on such land ; *Mimosa invisa*, *Tephrosia candida*, *Crotolaria striata* and *C. usaramoesis*. The last mentioned seems likely to prove the most satisfactory of all and to provide a large quantity of fairly soft vegetable material which will decay rapidly and form humus. It fruits and seeds freely and appears to grow well from self sown seed. These experiments are being continued.

6. A very successful demonstration was given by the Economic Botanist at the Padi Experiment Station, Titi Serong, in March. This was attended by numerous Malays, especially penghulus and ketuas. The superior tillering powers and yields of the selected padis were demonstrated and the work of the Experiment Station was explained. Several European and Malay Inspecting Officers attended.

7. Demonstrations in the field and lectures at Mosques have been given in Malay in various parts of the country on different subjects likely to be of local interest.

8. A highly successful Agri-Horticultural Show and Trade Exhibition was held by the Malayan Agri-Horticultural Association in Kuala Lumpur from June 30th to July 2nd. The Assistant Agricultural Inspector, Selangor, is Hon. Secretary of the Agricultural Section of the Association ; he had no difficulty in filling some 10,000 sq. feet of space with agricultural exhibits. There was a successful Show in Seremban in March and Shows were held in numerous other centres during the year. Officers of the Inspection Division assisted, either as Judges, or Committee Members, or in other capacities, at the majority of these shows.

The Inspection Division also assisted in collecting material for exhibits in the Agricultural Section of the Malaya Pavilion at the British Empire Exhibition to be opened next year. The Assistant Agricultural Inspector, Selangor, became Hon. Secretary of the Agriculture Section Committee, British Empire Exhibition, in January 1923. This post entailed a lot of work particularly during the second half year.

The work of the Division has steadily grown and extended in recent years. This has rendered necessary certain measures for decentralisation which it is hoped to put into operation next year. These are expected to relieve the Chief Agricultural Inspector of excessive routine correspondence on subjects of minor importance and considerably to expedite work and improve efficiency.

ANNUAL REPORT OF THE ECONOMIC BOTANIST FOR 1923.

By H. W. Jack.

Staff.—H. W. Jack, Economic Botanist; W. N. Sands, Assistant Economic Botanist; Inche Ahmad bin Johar, Junior Agricultural Assistant; Inche Din, Junior Agricultural Assistant; Inche Mohamed Zain, Probationary Assistant; and S. Amar Singh, Clerk.

I desire to express my appreciation of the good work done by the entire staff throughout the year.

Padi.—Experimental work with rice was continued and was regarded as the major problem in the programme of work. During the first two months of the year a number of visits were made to areas in Perak where selected seed had been planted in the previous year through the agency of the Assistant Agricultural Inspector, Perak North. These visits clearly showed that natural distribution of departmental seed was taking place, for in several places where only 2-3 gantangs of seed had been sown in the previous year, it was found that the entire crop had been re-distributed to neighbouring cultivators for seed and planted by them. As an example, the Ketua Omar in the Tanjong Piandang Mukim of Krian can be mentioned. He received three gantangs of seed (Seraup 36) 2 years ago and planted a small part of his land with it. This season there are 32 orlongs (over 40 acres) of this padi growing in one block around the Ketua's land, and it is readily acknowledged as a very fine and even cropper by the neighbouring rayats who are already asking for seed. Similar results have been reported in various places. During the present season, distribution has been extended to South Perak and in a small way to Selangor, Negri Sembilan and Malacca, and the following extract from a report from the District Officer, Lower Perak, is worth quoting:—

> "In Bandar and Pulau Tiga mukims, Government padi seed has done extraordinarily well—the plants have tillered wonderfully and the plots are now overcrowded. There is no doubt but that in these mukims, provided the Government padi yields as it looks like yielding, every gantang will be saved for seed and practically nothing else planted next year. Even if not pointed out to me, I could distinguish the Government padi by the extraordinary multiplication of each 'perdu' which is at least twice as thick as any local variety."

Again in Kedah at Telok Kechai, strain S. 52 which was planted on one acre by the Agricultural Officer, Kedah, is acknowledged to be the best crop in the neighbourhood, and the entire crop has been booked for seed by the local cultivators. Similarly, strain R. 3 at Kuala Muda has produced 700 gantangs per acre, though in this area the soil

is particularly fertile. The Assistant Agricultural Inspector, Negri Sembilan, reports that selected seed, though the crops are not yet harvested, promises good result as the standing crops show stronger tillering and are much more even in growth than local varieties.

Selected seed does not succeed under all conditions however, for in parts of Malacca and Province Wellesley such seed has not responded to expectations except in certain areas. In Belimbing in Malacca, for instance, two selected strains P. 1, and R 13, are reported to have done remarkably well. In one area in Province Wellesley, strain R. 1 has yielded heavily. At the Pulau Gadong Padi Experiment Station in Malacca, Krian selected strains have done very badly compared with local varieties, though the very deep tractor ploughing and consequent unheaval of the raw subsoil may have been the cause of failure, the selected strains not being accustomed to such conditions.

At the test station at Talang (Kuala Kangsar) strain R. 13 yielded excellently last season and was much in demand by the local cultivators for this season's sowing. This strain has been used on that area again this season where the manurial experiments, originally started in 1916 but abandoned in 1918 owing to lack of funds, were once more resumed. Unfortunately, the very prolonged drought has not helped these experiments, for lack of rain led to irregular planting of the plots, some being planted as much as six weeks later than the others. However, good healthy growth is reported though climatic conditions will not be quite similar for all the plots, and hence the reliability of results will be somewhat diminished this season. It was hoped to establish manurial experiments in Province Wellesley also, and a preliminary crop was planted on the land earmarked for this purpose to test its uniformity from the point of view of yield.

At the Titi Serong Rice Experiment Station in Krian, further tests of 77 selected strains were made under pure line conditions, each strain being planted in quadruplicate plots of 100 plants per plot. From the results at harvest the number of strains for continuation tests in the present season was reduced to 34. Each of these has been planted as in the previous season in quadruplicate plots of 100 plants each. In addition to the maintenance of the pure line tests of the best selections, the best 12 strains of the previous season were planted in plots varying in size from $\frac{1}{2}$ an acre to 4 acres for multiplication purposes to meet any demands for seed. Foundation stocks were maintained as in the previous season (230 varieties) and 4 selections from them were planted for intensive yield trials, these selections being included in the pure lines mentioned above.

The last padi harvest was a fairly good one, though yields were slightly below average because of very deep water in the planting season. This season dry weather caused a postponement of sowing with the result that when the floods came, the seedlings were too weak to withstand them and many succumbed, necessitating re-sowing of nurseries in many cases. Apart from these floods which covered the land and submerged all the nurseries from 11th to 16th September, the rainfall has been normal and the plants have picked up well, though the tillering is likely to be below average on account of the weakening effect of the flood.

Owing to the vagaries in the depth of water rats have been unusually destructive this season, all the padi in the neighbourhood of the Experiment Station having suffered badly. Poison baits, particularly arsenic and barium carbonate, served well in checking their depredations, and carbon bisulphide was also used to good purpose on the irrigation bunds.

The results obtained from pure line selection work up-to-date have been recorded in Bulletin No. 35 " Rice in Malaya " which was published during the year under review.

The land being dry during 1923 harvest, an effort was made to establish elementary cultural and manurial work at Titi Serong—6 half-acre blocks of land being used for the purpose.

Each block will continue to be cultivated or manured as it was in 1923, season after season, whenever the irrigation permits. These experiments will form a useful nucleus for future work as a time will come when the fertility of Krian will require to be assisted by cultivation, if good crops are to be maintained.

Considerable interest was taken in pure line selection work by parties of Malay cultivators, Penghulus and other from various parts of the country, who visited the Station just before harvest. Some 250 visitors were shown around the Station, and the methods of selection were explained and demonstrated and apparently appreciated.

The demand for selected seed of the best strains far exceeded the supply, over 2,500 gantangs being supplied to applicants.

In connection with the milling of rice, a circular was printed and sent to Estate Managers, District Officers and others likely to be interested in the matter. It is worthy of note that the use of small power mills, recommended by this Division, is slowly extending amongst estates situated near large rice producing areas, and reports show that they are giving every satisfaction. The use of the 'kisaran' for milling amongst natives who have no available source of power was demonstrated at Jeram and Temerloh and to numerous Malay visitors to Titi Serong, and the Inspection Division of the Department reports that the use of the 'kisaran' is gradually replacing the much more laborious 'lesong' in several places.

An exhibit of padi attracted much attention at the Agri-Horticultural Show which was held in Kuala Lumpur in June.

During the last 3 months of the year a considerable amount of time was given to the collection, fumigation and preparation of the following exhibits for the British Empire Exhibition.

1. Series of large photographs showing the methods of rice cultivation.

2. 35 jars of padi to illustrate varieties of rice.

3. 12 glass-topped boxes (divided) of padi and rice of selected strains, with cards to show yielding ability of each.

4. 12 glass-topped boxes of "other cereals" (maize, ragi, millets etc.)

5. 5 glass-topped boxes of "root" crops (tapioca, groundnut, sweet potato etc.)

6. 8 glass-topped boxes of "Pulse" crops (beans and grams etc.)

7. 1 glass case containing 18 specimens of various rices in ear form.

8. 21 models of padi implements etc.

9. 6 mounted specimens of food plants.

10. Photographs, maps etc., of Krian Irrigation Scheme.

11. Exhibit of coconuts.

12. Exhibit of fibres and ropes (rozelle, hemps, jutes, kapok cotton etc.)

13. Exhibit of paper making materials (bamboo, grasses etc.)

14. Articles on "Cereals" and "Cotton" were written for the Exhibition Handbook which is being prepared.

The exhibits were dispatched at the end of the quarter.

The usual statistics regarding the area under rice and the yields obtained in each district were collected from District Officers and are compiled in the following tables. :—

FEDERATED MALAY STATES.

	1922.			1923.		
	Area in acres.	Yield in gantangs.	Average yield per acre.	Area in acres.	Yield in gantangs.	Average yield per acre.
Perak	115,296	24,450,591	212	106,734	24,276,546	227
Selangor	20,862	3,081,834	147	11,635	1,737,172	149
N. Sembilan	30,695	5,189,654	168	30,756	5,196,151	169
Pahang	30,061	5,318,347	176	28,472	4,581,861	161
Total F.M.S.	196,914	38,040,626	192	177,527	35,791,730	202
KRIAN	54,870	13,925,830	254	54,605	14,484,806	265

STRAITS SETTLEMENTS.

	1922.			1923.		
	Area in acres.	Yield in gantangs.	Average yield per acre.	Area in acres.	Yield in gantangs.	Average yield per acre.
Malacca -	26,409	8,486,024	321	26,500	7,950,000	300
Dindings -	635	110,300	170	695	77,475	111
Penang -	5,150	2,558,000	497	5,150	2,033,040	395
P. Wellesley -	31,000	10,291,000	332	44,700	14,350,000	321
Singapore -	...	...	...	...	...	...
Total S.S. -	63,194	21,445,324	339	77,045	24,410,515	317

UNFEDERATED MALAY STATES.

Kelantan -	179,660	33,924,000	183	169,995	33,799,300	199
Kedah -	129,177	37,302,194	288	147,009	48,452,102	330
Trengganu -	10,830	2,000,000	184	11,000	1,700,000	155
Perlis -	29,624	5,847,200	197	29,125	7,361,920	253
Johore -	15,075	1,485,148	98	16,990	840,001	49
Total U M.S. -	364,366	80,558,542	221	374,119	92,153,323	246

SUMMARY—MALAYA.

Total F.M.S. -	196,914	38,040,626	192	177,597	35,791,730	202
Total S.S. -	63,194	21,445,324	339	77,045	24,410,515	317
Total U.M.S. -	364,366	80,558,542	221	374,119	92,153,323	246
Grand Total -	624,474	140,044,492	224	628,761	152,355,568	242

Coconuts.—Individual tree yields of fruit were maintained monthly from 450 trees in connection with the study of individual tree variation in yield, the establishment of correlations between type of tree and yielding ability, the examination of periodicity of yield, the search for good yielding trees under estate conditions for further genetic research and the comparison of their yielding abilities for future use as seed producers. A study is also being made of different varieties of local and introduced types with a view to classification.

As effort was made to collect statisties of areas under this crop, and though the following figures cannot be regarded as accurate as the areas are in many cases calculated from the number of trees assuming 50 trees per acre as a fair stand or from copra exports still they show the comparative areas and are probably not very far wrong.

F.M.S.		S. S.		U. M. S.	
	acres.		acres.		acres.
Perak	75,280	Singapore	6,560	Johore	12,500
Selangor	62,120	Dindings	6,000	Kedah	27,550
N. Sembilan	4,850	Malacca	45,000	Kelantan	70,900
Pahang	19,400	Province Wellesley	55,000	Trengganu	8,000
		Penang	15,000		
Total	161,650	Total	127,560	Total	118,950

Grand Total Malaya 408,160 acres.

A much larger area than that indicated in the above figures was reported as planted with coconuts, but as the areas were frequently quoted as land alienated for "coconut and rubber" or "coconut and fruit" or "kampong" cultivation very considerable reductions had to be made based on the average number of trees per acre.

Cotton.—Pure line selection work was continued in 1923, the aims being to maintain pure stocks of the several strains under trial and at the same time to ascertain which types were most suitable for cultivation on a commercial scale in Malaya. Fourteen types were grown as pure lines during the season, selfed seed being obtained of each type and individual plant selections were made of all types except 2 which failed to germinate. Of the above number of types, 4 were Egyptian, 6 West Indian Sea Island, 2 local indigenous, 1 Indian imported, and 1 American Upland. The two types which failed to germinate were the American Upland and the Indian type. Types of Sea Island cotton classed commercialloy as "fine ordinary" grow and yield well but the cotton from them only being used in the luxury trades, for which there is little demand at present, the market for such types is limited; indeed, heavy stocks have accumulated so that there is likely to be no appreciable market for some years to come.

Owing to the market conditions it has now been considered advisable to recommend the cultivation of Egyptian types, such as Sakel and "310" and selections from them, since these types are always saleable though they usually command a lower price than the finer longer-stapled Sea Island strains.

A strain of the fine Egyptian variety " 310 " (E.B. No. 3) which is now being very extensively cultivated in Egypt, where it is considered to be superior in certain respects to the well-known " Sakel " has grown satisfactorily and yielded well during each of the last two years, and appears to be the best type for local conditions as the lint commands a ready sale in the United Kingdom. The original type was selected by Dr. Lawrence Balls in Egypt on account of the whiteness and length of lint and its productive capacity, and these characters do not appear to have depreciated under cultivation in this country. Grown in the lighter soils, due to the season of sowing and with the requisite attention to pest control, E.B. No. 3 promises to become a useful economic crop in Malaya, though at present it is not so prolific a yielder as some of the finer types. Type E.B. No. 16 is also a promising one. As regards yields of lint, these depend, naturally, on the fertility of the soil, on favourable climatic conditions and on the incidence of pests which are controllable if rightly attacked. The yields of lint in the island of St. Vincent, British West Indies, where some 4,000 acres are planted annually, averaged 95 lbs. per acre over the past 11 years (Report on The Agricultural Department, St. Vincent, for the year 1922, page 28), and it is safe to state that local yields during the past two years have been well up to that average. Of course, very fertile blocks of land in St. Vincent have yielded over 300 lbs. lint per acre, but similarly fertile blocks have produced up to 150 bolls per plant in Malaya which should work out to about 300 lbs of lint per acre.

Enquiries for cotton seed have been received from several sources in Malaya and from Java and small sample lots of seed have been distributed for trial, though it is feared that such small trials will not get all the attention they require to make them a success.

The chief difficulty in establishing cotton in Malaya would appear to be that it is an annual crop and as such requires intensive cultivation as opposed to the extensive methods to which our agriculturists are long accustomed.

Should the market for the finer staples improve, types E.B. No. 4 and E.B. No. 6 are prolific yielders and have been thoroughly tried in Jelebu, Kuala Lumpur and South Kedah, and samples of lint have been priced by the Manchester Spinners' Association at 20-22 pence per lb.

The damage done to cotton plants by insect pests is usually greater on poor soils, so that given good conditions for growth, the loss caused by insects need not be extensive always provided that approved methods of control are practised.

Drugs.—The study of native medicinal plants was rather set back by the inability of the Chemical Staff to undertake analysis of material grown, owing to the pressure of other work. The shortage of staff at the Government Laboratories prevented that Department also from doing the necessary analysis.

The only analyses which were completed were those of the two species of *Datura Stramonium* by the Agricultural Chemist. This analysis showed that in sun-dried leaves, type No. 1 (green stemmed) contained ·4 per cent. of scopolamine and type No. 2 (red stemmed) contained ·25 per cent. Type No. 1 may be valuable commercially and a sample is being sent to the Imperial Institute for valuation.

Samples of the following drug plants were prepared for analysis which did not materialize :—

1. Vitex trifolia.
2. Euphorbia tirucalli.
3. Ocimum basilicum.
4. Croix lacryma jobi (roots).
5. Justicia gandarusa.
6. Bryophyllum calycinum 6.
7. Jatropa sp. 7.
8. Dionella ensifolia 8.
9. Blumea balsamifera 9.

Botanical.—A study was made of the species of Aleurites producing Candle-nut and Chinese Wood Oils, and a paper on these was written for the Malayan Agricultural Journal.

The different species of Mistletoe attacking cultivated trees were collected and studied in different districts. These were identified and photographed, and an illustrated article on them was prepared for publication.

The small herbarium belonging to the Division was re-arranged and numerous specimens of economic importance were collected, dried and added to it. This is a good nucleus for the formation of a Departmental Herbarium for reference purposes.

As in the previous year a large number of plants were identified for other officers of the Department and planters.

Rubber.- Little attention is given to this crop, though records of individual tree yields are maintained monthly for the purpose of further investigating variation in yield, periodic yields, and of finding high yielding parent trees for ultimate seed selection should such work be made a part of the Department's programme. These records are also useful in connection with vegetative propagation experiments and for the study of genetics.

ANNUAL REPORT OF THE MYCOLOGIST FOR 1923.

By A. Thompson.

Staff.

Mr. A. Sharples, Mycologist. went on long leave on the 17th July. Mr. A. Thompson, Assistant Mycologist, acted as Mycologist from that date. Mr. F. R. Mason, Assistant Mycologist, was principally engaged on investigations of the diseases of the coconut palm.

Additional Buildings.

A new culture room and a preparation room were added to the Mycological laboratory in December. These will greatly assist the work of the section.

Hevea Bark Diseases.

Brown Bast.—

An experimental area, opened upon up on December 23rd, 1922, was tapped daily on 2 opposite V's each on half the circumference. Daily yields of the rubber were recorded along with records of the rainfall for the year on the plot. Observations on wintering, flowering and fruiting of the trees were made during the period. The bark of each tree was examined microscopically, and records kept. It was thought that information would be available towards the end of the year, but no significant results have been obtained as yet. A control plot was opened up in June; this was given the same treatment as the No. 1 plot.

Mouldy Rot. (*Sphaeronema fimbriatum*).—

This disease has extended its boundaries considerably during the year. It appeared in Kuala Lumpur district towards the end of the year, and in time is likely to become so widespread, that its control will become a matter of Estate routine especially during wet weather. The position need not be considered alarming as it has been demonstrated than an effective and simple control can be procured, at a reasonably low cost.

Moulds.—

From time to time specimens of moulds on renewing bark have been received for diagnosis and enquiries as to whether Mouldy Rot was present or not. In many cases there was no trace of Mouldy Rot, only saprophytes being present. Visits to the areas from which the specimens were received, afforded some evidence that the saprophytic moulds were growing:—

(1) On bark which had been tapped too deeply and which had been affected by the sun.

(2) On thin bark which had been burnt by too strong a solution of certain disinfectants.

Black Stripe. (*Phytophthora sp*).—

Demonstrations of this disease were given to planters, on trees inoculated with the fungus so as to show the different stages in the attack.

A possible new bark disease.—

A number of enquiries were received from Estates at the beginning of the year, in connection with a fungus growth on the renewing bark. This growth is a white mycelium which previously grew over renewing bark from the top corners of the tapped panel forming a sheet of fungus varying from 1"–3" in width. It was not noticed to be doing any damage. During 1923 however, it began to grow lower down the panel and to penetrate the bark to a slight extent, and towards the end of the year a few specimens were received which showed that the fungus was capable of penetrating to the wood. Attempts to inoculate trees have not been successful, and, so far, cultures of the fungus have remained sterile. The latest attack showed that the fungus can appear in 3 weeks on a newly opened cut. In this instance there were four plates of fungus mycelium, about $\frac{1}{2}$"–1" above the tapping cut and varying from 1"–6" in width. The bark beneath the centre of each patch was rotted and the deterioration had spread in to the wood. Up to the present fhe fungus has proved amenable to treatment by application of Agrisol or Brunolinum. The trouble is not yet very serious as only a few trees become affected at a time. Investigations on this disease are in progress.

Root Diseases of Hevea.

A representative collection of the common root diseases of Hevea, was collected for the British Empire Exhibition. These proved of interest to various planters and visitors who came to the laboratory while the specimens were being dried and prepared.

Fomes lignosus and *Fomes pseudo-ferreus* were the commonest root diseases dealt with in 1923. The latter, especially, was met with on Estates which are increasing their activities in disease control, and searching for cases of root disease.

Die-back.

Several Estates were visited in connection with a dying back of the crown and branches of rubber trees. The trouble was not always due to a specific root disease. In one instance the trees in a small area had been flooded frequently, and as a result were growing in very swampy ground. This undoubtedly was the cause of the die-back.

On another Estate the trouble appeared on 27 year old trees. The soil in this area was very dry and had been subjected to a steady wash. The trees were very poorly developed and gave little latex. Only a few cases of root disease were found, and the die-back was due to soil wash and starvation of the trees.

Die-back was also encountered on an area of 2 year old trees. The trouble was confined to about three rows where about 30 trees had suddenly died back in a couple of days. A visit to the area revealed the fact that lightning was responsible for the damage. Boring beetles and the fungus *Diplodia* were prominently associated with the dead trees.

Pink Disease (Corticium Salmonicolor.)

Trouble with bud-grafting was experienced on an Estate in a Pink Disease area. It was found that the bud-wood was being obtained from branches which had been treated for Pink Disease The disease had caused the buds to "start" slightly, and this appeared to be the principal cause of the failure to establish the bud-grafts.

Loranthus Pentandrus.

This parasitic plant called for attention in the earlier part of the year. It had established itself on a large area of rubber trees in Negri Sembilan. About 60% of the trees in a 200 acre plot were affected, and although the trees were wintering, and had shed most of their leaves, this was not noticable from a distance owing to the luxuriant foliage of the Loranthus. As the trouble was spreading rapidly control measur s were instituted, i.e. pruning the affected branches. The area was then put out of tapping for a few years to allow the trees to recover. The parasitic alga (*Cephaleuros mycoidea*) was noticed, growing on the leaves of the Loranthus.

Coconuts.

Bud-Rot.—

Bud-Rot as an epidemic disease remains practically non-existent in Malaya. Throughout the whole year only 9 cases have been observed that bore any resemblance to Bud-Rot as described by various writers in other tropical countries. In the majority of cases, when a bud is rotting, it can be put down to some other primary cause or interference with the life processes of the palm.

A New Disease.—

A hitherto unrecorded disease of the Coconut palm has appeared. On one Estate an area of about an acre had been completely wiped out before its seriousness was known. Infection undoubtedly takes place by means of root contact as the palms appear to die off in an ever-widening circle.

The spread of this disease was successfully checked by the digging of isolation trenches. The same disease has been suspected in one or two other localities but has not reached such proportions as in the first instance.

Stem Bleeding.—

More definite information on stem-bleeding has been obtained during the year. There appear to be 3 distinct types.

(1) The common type, which appears to be caused by a disease of the "bark" or outer 1½" of soft tissue. the bleeding taking place from all available cracks in the bark.

(2) Bleeding from abandoned White Ant galleries. These two types do not appear to affect the growth of the palm to any great extent.

(3) A Bleeding, usually occurring from one single wound in the stem and associated with the unrecorded disease described above. This bleeding is so profuse that when the wound is further opened with a knife, as much as ½ pint of pus-like liquid is sometimes ejected with considerable force.

Leaf Spots.—

Pestalozzia palmarum has been reported from practically all districts, but only in one instance has it done any considerable damage, when it practicaly wiped out a small plantation of one year old Dwarf Coconuts.

Red Ring Disease.—

One case of suspected "Red Ring Disease" has been found, but although typical symptoms were apparent, no trace of the nematode worm said to be responsible for this disease, could be found in any of the diseased tissue, so that we cannot record this as a definite case of "Red Ring disease" which, hitherto, has not been reported in this country.

Routine work in the laboratory has been carried on, in connection with diseases under observation.

African Oil Palm.

A case of bent-leaf disease has been observed in young African Oil Palms in the Kuala Lumpur plantation, otherwise Oil palms have given very little trouble.

Gutta percha (Taban Merah.)

Various diseases of Taban have been studied and several visits were made to the Forest Reserves in this connection. Taban seedlings require considerable shade when young, and one (self planted) area

had died as a result of clearing away the natural cover afforded by the undergrowth. The fungus *Diplodia* attacked the weakened shoots and hastened the end.

Black lines were noticed in the collar and roots of young trees and layered Taban plants. These have yielded an interesting fungus which is being studied.

Brown-root disease also occurs on Taban.

Chlorosis of the leaves of seedlings was encountered in one nursery. No organism could be demonstrated or cultured.

Tea.

A visit was made to a Rubber Estate on which a small area was under Tea. This crop was attacked by many diseases probably owing to bad conditions of cultivation.

Roselle Fibre.

Hibiscus sabdariffa var altissima.—

A new disease of this crop was noticed in some pot plants on the Kuala Lumpur plantation.

The tips of the young plants died back rapidly, and in a short time the whole plant withered in a characteristic fashion. The dead portion was covered with pycnidia of a species of *Phoma* but only backward plants seemed to be affected.

Bacterial wilt of Roselle was prevalent on one of the plots of Serdang Experimental plantation. The disease was very marked when the plants were young. Control measures were instituted and appeared to be successful since the crop is now doing well.

Roselle is also subject to the attack of eel-worms and several specimens showing eel-worm attack were examined.

Tobacco. (Nicotiana Tabacum.)

This crop was attacked by *Bacillus solanacearum* on Kuala Lumpur plantation. Eel worms were active also and killed about 25 per cent. of the plants in one small plot. *Cercospora Nicotianae* was prevalent; it is more active on the lower leaves and was kept in check by picking these leaves and burning them whenever they became diseased.

Tuba Root. (Derris Elliptica.)

Pink Disease (*Corticium Salmonicolor*) was recorded as attacking the stems of this plant.

Jerusalem Artichoke. (Helianthus Tuberosus.)

Rhizoctonia sp., did considerable damage to artichokes. The same fungus also attacked *Crotalaria usaramoesis* on Serdang Experimental plantation.

Specimens of Field Corn were received from Johore suffering from an attack of *Helminthosporium* on the grain. The whole plot was destroyed by this fungus. The same crop on Serdang Experimental plantation was not affected.

Borneo Camphor.

An outbreak of root disease caused by *Rosellinia bunodes* was reported from Kanching Forest Reserve. The trouble was taken in hand early and the disease did not spread.

Brachartona Catoxantha.

This dangerous pest of the coconut palm is said to be kept in check to a certain extent by a fungus (*Botrytis sp.*) which parasitises it. Specimens of the fungus were sent to Fiji where a similar pest of the coconut palm does considerable damage.

Mosquito Larvae.

Some time was spent in investigating some dead Anopheline mosquito larvae sent in by the Malarial Bureau. The bodies of the larvae were full of elliptical greenish-brown organisms. These were studied and identified as being similar structures to the sporangia of the fungus *Coelomomyces Stegomyiae.*

Before going on leave Mr. Sharples served on a Committee to report on certain proposals made to the Government for "the formation of a Co-operative Society of Rubber growers to undertake bud-grafting and seed selection work, in connection with Para rubber."

A series of lectures in Mycology were given to the Malay Officers of the Department.

Work in connection with the British Empire Exhibition occupied a considerable portion of the last quarter of the year.

The following papers were contributed to the Malayan Agricultural Journal by the Mycologist.

(1) Preliminary Report on Brown Bast Experiments.

(2) Treatment of Mouldy Rot, (Final Report.)

(3) Black Fruit Disease of Pepper Vines in Sarawak.

ANNUAL REPORT OF THE GOVERNMENT ENTOMOLOGIST, FOR 1923.

By G. H. Corbett.

(1) Staff.

Government Entomologist, G. H. Corbett; Assistant Entomologist, B. A. R. Gater.

Mr. Malcolm Miller, Temporary Assistant Entomologist, resigned his appointment on the 28th February.

Mr. Daniel Ponniah, Insectary Assistant, proceeded to India on leave on the 5th April and reported for duty on the 18th July.

(2) Visits.

During the year 27 Estates were visited by the members of the European staff. Mr. B. A. R. Gater went on two tours of about ten days each through Negri Sembilan, Malacca and Perak.

(3) Publications.

Articles on the following subjects have been published during the course of the year :—

"Preliminary note on *Plesispa reichei*, Chap."

"Summary of observations on *Rhynchophorus schach*, Oliv."

"Food plants of *Leptocorisa* spp."

"Annual Report for 1922."

Special Bulletins on *Rhynchophorus schach*, Oliv. and *Plesispa reichei*, Chap., mentioned in my report for 1922, are now actually in the printers' hands.

(4) Agri-Horticultural Show.

An exhibit of Live Insects harmful to economic crops was prepared.

(5) Insecticides.

The value of *Derris* ("Tuba"), as an insecticide has come up during the past year and plants are being grown in various localities. An effort has been made to collect and compare the insecticidal values of a number of plants indigenous to Malaya. *Derris* has a distinct usefulness as an insecticide in a restricted manner. It cannot at present be compared in efficiency or price with many other new and established insecticides and it is dangerous to make recommendations which would encourage its growth on a large scale until more definite

information is obtained, especially with regard to the toxicity of the various species. It is at present advertised as being non-poisonous to man and animals. This statement is incorrect. It is both poisonous to man and animals to no small degree and is an abortifacient.

There are very few insecticides available in this country and during the year a system of testing the efficacy of insecticidal substances under local conditions has been started. Several proprietary articles have been obtained and examined.

(6) Household Pests.

Advice has been sought on numerous occasions by householders especially with regard to "borers" in timber, bed bugs and ticks. Enquiries of this nature are welcomed and it is hoped that such enquiries will increase. It is noteworthy that many who suffer from the effects of household pests do not know to whom to apply for recommendations as to treatment.

(7) Locusts.

Locusts have already been troublesome in Malaya and there seems to be a general impression that the locust was introduced and that there is no danger of recurrence. *Locusta migratoria*, L. ph. *migratorioides*, Rch and Frm., which is the insect concerned, is well known and except for the Palaearctic Region has the same range as L. *migratoria*, L., ph. *danica*, L., which extends practically through the whole of the Eastern Hemisphere.

It is well known that locusts have permanent breeding grounds and these were never investigated during the outbreak. Breeding grounds referred to in Bulletin No. 24 of this Department obviously deal only with the temporary breeding grounds of migrated swarms. It is probable that permanent grounds are situated in the depths of the forests.

It is most essential that all concerned should realise that another outbreak may occur at any time.

(8) Pests and Cover Crops.

From an entomological point of view the practice of growing cover crops has proved itself on several occasions to be dangerous. Among other instances the following may be mentioned. *Valanga nigricornis*, Burm. seriously damaged young coconut palms growing in a cover crop of mimosa, adjacent areas where no mimosa was growing being entirely free. *Hypomeces squamosus*, F. and *Adoretus compressus*, Weber, both common leaf eating beetles which do considerable damage, are particularly injurious where the soil is not clean-cleared. Slugs damaging young rubber are also harboured by cover crops.

(9) New Species.

The following insects new to science were described from material forwarded to the Imperial Bureau of Entomology, London.

Rhynchota, Coreidae, Leptocorisa corbetti, China, on Padi.

Hymenoptera, Chalcidoidea, Chalcididae, Harmolita aequidens, Waterston, on Bamboo.

A paper on the various species of *Leptocorisa* found in padi fields in Malaya is practically ready for publication but has been held up awaiting full descriptions of the five species now known to be present.

(10) Investigations of Crop Pests.

(A) *Batrachedra arenosella*, Wlk. (*Cosmopterygidae*) on Coconut flowers in the unopened spike.

Preliminary work extending over several months has been concluded and it is hoped that the results will be published shortly.

The outstanding features are the apparent small actual damage caused by the caterpillars, the enormous amount of fall of flowers and immature nuts due to other causes, and that a 80 per cent. control of this insect has been found.

Tirathaba sp. near *trichogramma*, Meyr. (*Pyralidae*). This moth is the most important pest of Coconut flowers of the opened spike and the caterpillars have frequently been found boring the female flowers.

Detailed work on the life history has been made and field experiments for its control were instituted at the beginning of October. They are still in progress and the results are encouraging.

Two Ichneumonid parasites, neither of which was represented in the British museum, have been discovered, i.e., *Campoplex* sp. and *Anilasta* (?) sp.

Facilities for carrying out both the above series of experiments were kindly provided by managers of the respective estates.

(B) Detailed investigations were carried out on the following insects :—

Scotinophara coarctata, Fb. (*Pentatomidae*) on Padi.

Dysdercus cingulatus, F. (*Pyrrhocoridae*) on Cotton.

Alcides leeuweni, Hllr. (*Curculionidae*) on "Kapok".

Epilachna indica, Muls. (*Coccinellidae*) on Datura.

Spodoptera abyssinia, Gn. (*Noctuidae*) a general feeder.

Achaea janata, L. (*Noctuidae*) on Castor.

Sylepta derogata, F. (*Pyralidae*) on Brinjal.

Antigastra catalaunalis, Dup. (*Pyralidae*) on Gingelly.

An interesting observation was made during the study of *Dysdercus cingulatus*. An insect of the same family, *Antilochus coqueberti*, F., was found to have the apparently unrecorded habit of attacking and feeding upon *cingulatus*, and would appear to be a check of some importance where it exists. It is also interesting to note that the nymphs of *D. cingulatus* are frequently predaceous on sickly or dying members of their own species.

A paper on *Scotinophara coarctata* has already been prepared for publication.

(C) During the year it has been possible to embark on the keeping of a complete record of pests in Malaya on all crops. The greater part of this year has been devoted to the institution and perfection of a system whereby all insects coming into the laboratory are bred out on their food plants and records and observations taken. These are filed in such a way as to be easily accessible for future reference.

During the year more than 800 batches of insects were dealt with in this manner and a position has already been reached whereby an index of insects under food plants is available. A large number of insects can now be identified with certainty by this Division since a collection of correctly determined types is available in the Laboratory.

It might be mentioned in this connection that a large number of economic insects is unrepresented in the British Museum, which emphasises the urgent need of a complete survey of insects affecting crops.

The following is a list of some of the more important insects recorded during the year.

ORTHOPTERA.

Gryllidae.

Brachytrypes achatinus, Stoll. recorded on rubber buds.

COLEOPTERA.

Nitidulidae.

Lasiodactylus pictus, Mch. recorded on Lime and Rambutan fruits.

Erotylidae

Anadastus nigrinus, Wied. recorded on Padi flowers.

Coccinellidae.

Alesis discolor, F.
Chilomenes 4—plagiata, Swartz.
Coelophora inaequalis, F.
Scymnus sp.
} Predaceous on Aphids.

Bostrychidae.

Xylopsocus capucinus, F. on *Caryocar villosum*.

Chrysomelidae.

Aulacophora antennata, Baly. on *Pangium edule*.

Aulacophora lewisi, Baly. on Gourds.

Aulacophora similis, Oliv. on Gourds.

Monochirus moestus, Baly. on Sugar cane.

Monolepta bifasciata, Hornst. on Roselle.

Nodina fulvitarsis, Jac. on *Vigna catiang*.

Plesispa nipa, Maulik. on *Oncosperma tigillaria*.

Lamiidae.

Serixia sp. on *Barringtonia speciosa*.

Platyrrhinidae.

Araecerus fasciculatus, DeG. on Tephrosia and Cotton seeds in the field, and Brazil nuts.

Curculionidae.

Odoiporus longicollis, Oliv. on Banana.

Cosmopolites sordidus, Germ. on Banana.

Scolytidae.

Phloeosinus cribratus, Bldf. on Cloves and Nutmegs.

RHYNCHOTA.

Pentatomidae.

Dinidor obscura, Lep. and Sev. on *Erythrina indica*.

Eusarcoris ventralis,, Westw. on Padi.

Menida histrio, F. on Padi.

Scotinophara cinerea, Le Guill. on Padi.

Coreidae.

Leptocorisa acuta, Thnb. on Padi and Grasses.

Leptocorisa lepida, Bredd. on Padi and Grasses.

Physomerus grossipes, F. on *Vigna catiang*.

Reduviidae.

Euagoras plagiatus, Burm. (?) probably predaceous on *Leptocorisa* spp.

Fulgoridae.

Lawana conspersa, Wlk. on *Aleurites montana* and Indigo.

Aleurodidae.

Aleurocanthus spiniferus, Quaint. on Citrus.

Coccidae.

Paralecanium expansum, Var. *metallicum*, Green, on Nutmegs.

LEPIDOPTERA.

Papilionidae.

Papilio clytia clytia, L. on Cinnamon.

Papilio polytes romulus, Cram. on Lime.

Nymphalidae.

Amathusia phidippus, L. on African Oil Palm and Coconuts.

Hesperiidae.

Hasora alexis, F. on *Derris* sp.

Arctiidae.

Amsacta lactinea, Cram. on Tea and Chillies.

Creatonotus transiens, Wlk. on Vanilla.

Cyana ridleyi, Hamps. on Rubber bark.

Miltochrista exclusa, Butl. on Rubber bark.

Noctuidae.

Anomis flava, F. on Cotton.

Heliothis flavigera, Hamps. on Cape gooseberry.

Maranga diffusa, Wlk. on Padi.

Phytometra chalcites, Esp. on Cacao.

Xanthodes transversa, Guen. on Roselle.

Lymantriidae.

Nygmia scintillans, Walk. on Candle nut.

Sphingidae.

Theretra nessus, Dru. on Yams.

Saturniidae.

Attacus cynthia, Drury, on Pili nut.

Cossidae.

Duomitus ceramicus, Walk. on Teak.

Phragmataecia castaneae, Hb. on Sugar cane.

Limacodidae.

Chalcoscelis fumifera, Swinh. on Candle nut.

Cheromethia ferruginea, Moore. on *Derris* sp.

Pyralidae.

Caprinia conchylalis, Guen. on *Ficus elastica.*

Ephestia cautella, Wlk. on Beeswax.

Etiella zinckenella, Treit, on *Tephrosia candida.*

Psara stultalis, Walk. on Patchouli.

Pterophoridae.

Sphenarches caffer, Zell. on Pumpkin.

Eucosmidae.

Stomphastis plectica, Meyr. on *Jatropha curcas.*

Gelechiadae.

Stegasta variana, Meyr. on Groundnut.

Elachistidae.

Pyroderces ptilodelta, Meyr. on Cotton.

DIPTERA.

Agromyzidae.

Agromyza sojae, Zehnt. on Velvet bean.

Trypetidae.

Dacus ferrugineus, F. on numerous fruits.

Tachinidae.

Blepharipoda ophirica, Wlk. on *Tiracola plagiata.*

Cyphocera varia, F. on *Spodoptera pecten.*

Thelaira sp. nr. *luteicornis*, Walk. on *Parnara mathias.*

HYMENOPTERA.

Chalcididae.

Brachymeria euploeae, Westw., on *Caprinia conchylalis.*

Tetrastichus sp. on *Artona catoxantha.*

Ichneumonidae.

Goryphus maculiceps, Cam. on *A. catoxantha.*

Goryphus maculipennis, Cam. on *A. catoxantha.*

Xanthopimpla, sp. on *Erionota thrax.*

Xanthopimpla punctata, F. on *Sylepta derogata.*

Braconidae.

Elphea lutea, Cam. (?) on *Topeutis rhodoproctalis.*

Microgaster, sp. on *Artona catoxantha.*

(11) Bees.

Bee-keeping with the local variety of *Apis indica* was started during the year and certain progress made from the entomological point of view.

Apis indica has not proved to be a suitable bee in India and it has yet to be found so in Malaya.

Our results coincide with those obtained by Mr. Ghosh at Pusa, that *Apis indica* is a poor honey gatherer, extremely prone to swarming and cannot protect itself against the wax moth. The Italian bee has been found capable of resisting the latter pest which is very prevalent in Malaya.

It will probably be found that it is on the lines of obtaining a suitable bee for this country that a bee-industry will be successfully established. The importation of bees, however, attended as it is with the danger of introducing serious diseases, is again a matter which can only be accomplished by careful and accurate work, and should not be attempted except under scientific control.

ANNUAL REPORT OF THE AGRICULTURIST FOR 1923.

By F. G. Spring.

The Agriculturist (Mr. Spring) was in charge of this section of the Department throughout the year.

The Assistant Agriculturist (Mr. E. Farquharson) was in immediate charge of Kuala Lumpur Experimental Plantation, the Public Gardens, and the grounds around Government House, Carcosa, and the Sultan of Perak's Lodge, Kuala Lumpur. This officer also assisted the Agriculturist generally at headquarters.

Mr. E. Mathieu, Superintendent, Government Plantation, Kuala Kangsar, went to Europe on the 20th June, 1923, and on this date Captain Howlett took over charge of Kuala Kangsar Plantation. Mr. Mathieu returned from leave on the 26th December, 1923, and was reappointed Superintendent.

Experimental Plantations.

The following shows the expenditure and receipts from the Experimental Plantations Kuala Lumpur and Kuala Kangsar during the year.

Total upkeep expenditure, Experimental Plantation Kuala Lumpur ...	$18,996.25
Total upkeep expenditure, Experimental Plantation Kuala Kangsar ...	5,853.53
Receipts of rubber sold ...	4,014.72
,, ,, plants and seeds sold ...	2,518.54
,, ,, total produce ...	6,533.26

The amount of rubber, in store, at the close of the year was approximately 10,440 lbs.

All buildings were maintained in thorough repair, whilst roads, and drains, were kept in good order.

General Information.

In my report of last year reference was made to the interest shown by residents in crops other than established products, namely rubber and cocoanuts. This interest has not only continued but has increased considerably.

The following is a statement showing the subjects on which information was asked for and given :—

Agricultural Crops.—African oil Palm, Arghan fibre, Banana, Castor oil plant, Chaulmoogra oil, Coffee, Corn, Cotton, Furcraea fibre, Gambier, Groundnuts, Ipecacuanha, Jute, Kapok, Kola nut, Manila hemp, Maize, Nipah Palm, Pepper, Ramie fibre, Red Jersey Potato, Roselle fibre, Sago palm, Shea nut, Sisal hemp, Soya bean Tapioca, Tea, Tobacco, Tuba Root, Vanilla, and Vegetable Dyes.

Fruit Culture.—Banana, Papaya, Passion fruit, Pineapple and fruit culture generally.

Grasses.—Australian, Bermuda, Citronella and Guinea grass.

Cover Crops.—Leucaena glauca, Mimosa invisa, Tephrosia candida and Vigna oligosperma.

General.—Bud-grafting, Dairy farming, Methods for the prevention of soil wash, Poultry, Shade trees and Vegetables.

There was a large and constant demand for planting material and the Department was in a position to meet the majority of the applications, but instances where it was not possible to do so addresses of a suitable source of supply were given.

British Empire Exhibition.—Members of the Division devoted considerable attention to the preparation of specimens for the British Empire Exhibition, and to the writing of articles on Agriculture for the Handbook to be produced in connection with the exhibition.

Visit to Estates.—Several visits were made to estates to advise on the growing of various economic products and agricultural matters in general.

A list of growers of crops in the Peninsula, other than rubber and coconuts, was made on behalf of the Chief Agricultural Inspector F. M. S. for distribution to the Assistant Inspectors of the various states.

The Agriculturist acted on a committee for the management of the Batu Caves Tamil Settlement and was Honorary Secretary of the Gardens Committee during the year.

The Government plantations at Kuala Lumpur and Kuala Kangsar and the grounds around Government House, Carcosa and the Sultan of Perak's Lodge, Kuala Lumpur, were maintained in good order throughout the year.

Rubber.

Records of an experiment, to compare the yield obtained from individual trees of various ages, were kept.

Demonstrations on Bud-grafting of Hevea were held at Rantau, Banting, Malacca, Tebrau Estate, Kuala Selangor, Bukit Cheraka Estate, Jeram, and several at headquarters. Several estates were visited in connection with bud-grafting.

A lecture was given at Atherton Estate on "Drainage, Tillage and Green Manuring of rubber areas".

Several estates were visited to advise on replanting programmes.

Cover Crops.

Vigna oligosperma is rapidly gaining favour as a cover plant and during the second half of the year many applications were received for planting material. Seed of this legume is difficult to obtain and it is recommended to establish the cover by cuttings. Cuttings can only be had in limited quantities and it is advisable therefore to plant cuttings in nursery bed, under the best possible soil conditions, in order that a stock may be quickly raised for planting out in the field.

It has been reported that Giant mimosa (*Mimosa invisa*) on some estates commences to die back after it has been in the field for a period varying from 1½ to 2 years. The plants die back in patches, at first, but later larger areas are effected. *Centrosema Plumieri* remains a popular cover crop, but as mentioned in previous reports it only thrives well under good soil conditions.

Prevention of Soil Wash.

This has been dealt with in previous annual reports but I would again like to draw attention to the necessity of doing everything possible to prevent, or at least reduce, surface erosion. The surface layer is generally rich in humus and available plant food, consequently denudation is responsible for a reduction in fertility and of deterioration of the texture of the soil.

Fruit Culture.

Article on the cultivation of oranges, and of Avocado pears in this country were published in the Malayan Agricultural Journal.

Considerable success has been attained by the Department in the growing of the Avocado pear on the plains and there is every reason to believe that it will thrive on the hills. A good stock of seedlings has been raised for distribution. Melon seed were received from Siam and an experiment is being conducted to enquire if this fruit can be grown locally. It would appear that the season of harvesting is an important factor. Several Brazil nut trees yielded an excellent crop of nuts and it can now be definitely recorded that the tree is well adapted to local conditions. A number of Brazil nut seedlings were supplied to various applicants and a large number of seeds have been planted to provide material for future distribution. Plants of a good variety of lemon were raised by marcottage

A visit was made to Teluk Datoh with a view to planting up a collection of fruits in the grounds surrounding the Rest House. A scheme was prepared and the work completed by the end of the year.

Assistance was given to prospective fruit growers as regards methods of cultivation and the supply of planting material. A large quantity of seedlings which were somewhat large for the nursery were given free of charge to the Railway Department, F.M.S. and the occupants of the Chinese Agricultural Settlement.

A visit was made to Carey Island in connection with the marcotting of oranges and lemons.

A list of all persons supplied with fruit seedlings has been prepared and the Department is keeping in touch with growers.

Peas and Beans.

An endeavour is being made by the officers of the Department to encourage a local production of pulses, especially by Chinese market gardeners.

A good deal of attention has been given to the Soya bean (*Glycine Hispida*) which is a valuable food crop. It is a native of China and Japan where it has been cultivated for food from time immemorial. It is also a favourite food amongst Tamils. This bean has bean grown, in Malaya, from time to time, with varying degrees of success and it was considered that good returns could not be obtained unless a particular type was imported or a variety acclimatized to local conditions. A visit was made by Mr. Spring to Manchis, Pahang, as it was reported that the bean was being cultivated in that neighbourhood. It was found that upwards of 30 Chinese small holders are growing Soya beans successfully. A report on the subject has been prepared for publication in the Malayan Agricultural Journal. Seed obtained from Manchis has been planted at Kuala Lumpur, Kuala Kangsar and Serdang Experimental Plantations, and a trial is also being made at Tanjong Rambutan.

The growing of Lima Beans (*Phaseolus lunatus*) has been taken up by numerous planters and others and in several instances satisfactory reports have been received from the growers on the results obtained. Thirty eight applicants were supplied with seed. The Lima Bean is a favourite food with those familiar with it and deserves to be more generally cultivated. Very excellent yield have been obtained from the Lima Bean locally.

Tuba Root (Derris Sp.).

A quantity of Tuba Root was forwarded to the United States Department of Agriculture, Porto Rico, for experimental purposes. At the request of the Imperial Institute, London, a list of local suppliers of this product was forwarded to the Institute. Powder was

prepared from the roots and stems of two varieties of Derris and handed over to the Government Entomologist for experimental purposes. Several reports on the value of Derris as an insecticide were received from Australia.

Tobacco.

Reports on tobacco leaf grown at Kuala Kangsar Government Plantation were received from two local firms.

A sample of tobacco grown at Kuala Kangsar was submitted to the Agricultural Chemist for a report on the nicotine content of the leaf. The report states that this variety of tobacco contains over 5% of nicotine in the sun-dried leaves and that the species show great promise as an insecticide and compares very favourably with Nicotiana Rustica. The Agriculturist visited several cigar manufacturers in Kuala Lumpur who import leaf from Burmah and Sumatra and make the cigars in this country. It would appear that there is a considerable demand for tobacco leaf here, and the manufacturers are prepared to purchase locally grown tobacco.

Groundnuts.

Three estates were visited to advise on the cultivation of this crop. Figures have been obtained in respect of yields, percentage of oil, and cake, prices and costs of production from groundnuts grown on a commercial scale in this country. There is a very large importation of groundnut oil into the Peninsula and local growers should find a ready market for the oil and the nuts.

Roselle Fibre (Hibiscus Sabdariffa var. Altissima.)

The sale of Roselle ropes from one estate in Perak amounted to 7235 lbs. and the prices obtained by the estate were :—$\frac{3}{4}$ inch in diameter and upwards 20 cents a lb. and $\frac{1}{4}$ inch or less in diameter 45 cents a lb. The ropes found a ready market.

Samples of Roselle fibre and ropes were sent to Raffles Museum, Singapore, and to the Malay States Information Agency, London, for exhibit.

Kapok (Eriodendron anfractuosum.)

A stock of plants was raised from seed obtained from good yielding trees at Kuala Kangsar.

Bee-keeping.

A hive of the type suitable for *Apis indica* together with accessories was ordered and received from Ceylon. Two copies of the hive were made and it is proposed to carry out experiments on Bee-keeping at Kuala Lumpur and Kuala Kangsar Experimental Plantations.

A visit was made to the experimental farm attached to the Central Mental Hospital, Tanjong Rambutan. A good deal of planting material has been supplied by the Department of Agriculture for experimental purposes there. Experiments are being conducted at Tanjong Rambutan with the following : —fruits, vegetables, oil producing plants, fodder grasses and stock. The Department imported two pure bred Poland China boars from the Philippines for crossing with local stock ; the results obtained are highly satisfactory.

ANNUAL REPORT OF THE AGRICULTURIST, GOVERNMENT PLANTATIONS, FOR 1923.

By B. Bunting.

Staff.

Mr. B. Bunting, Agriculturist, was responsible for the administration of the Government Plantations; Pondok Tanjong, Kuala Tembeling, Castleton Estate, Telok Anson, the Experimental Coconut Plantation, Sapintas, and the Experimental Plantation, Serdang throughout the year and was assisted by Messrs. J. N. Milsum, T. D. Marsh and E. A. Curtler, Assistant Agriculturists and J. Lambourne, Superintendent, Government Plantations.

Mr. J. Lambourne returned from leave and assumed duty at the Experimental Plantation, Serdang on the 7th July, 1923.

Mr. J. N. Milsum proceeded on leave on the 2nd August, 1923 and Mr. J. Lambourne was appointed to act as an Assistant Agriculturist as from that date.

Expenditure and Revenue.

The following shows the expenditure and revenue, both estimated and actual, of the Government Plantations, Pondok Tanjong, Kuala Tembeling, Castleton Estate, Telok Anson, the Experimental Coconut Plantation, Sapintas, and the Experimental Plantation, Serdang, during the year under review.

Expenditure.

	Estimated.	Actual.
Government Plantation, Pondok Tanjong	$ 30,950.00	$ 30,246.38
,, ,, Kuala Tembeling	24,000.00	15,508.68
Castleton Estate, Telok Anson ...	32,000.00	23,198.51
Experimental Plantation, Sapintas ...	54,520.00	45,302.44
,, ,, Serdang ...	87,500.00	86,280.11
Totals ...	$228,970.00	$200,536.12

Revenue.

	Estimated.	Actual.
Government Plantation, Pondok Tanjong	$ 26,250.00	$ 39,520.63
,, ,, Kuala Tembling	200.00	252.90
Castleton Estate, Telok Anson ...	35,500.00	39,219.82
Experimental Plantation, Sapintas ...	7,500.00	8,499.98
,, ,, Serdang ...	1,000.00	849.26
Totals ...	$ 70,450.00	$ 88,342.59

The total expenditure for the above Government Plantations for the year was $200,536.12 against $236,535.36 in 1922, which is a further reduction in expenditure of $35,999.24, whilst the total revenue for the year was $88,342.59 against $64,813.93 in 1922, or an increase in revenue of $23,528.66.

The reduction in expenditure is due partly to the cessation of development work on plantations other than that at Serdang, which is devoted entirely to crops other than Rubber and Coconuts, and partly to the lower cost of materials during the period under review.

The large increase in revenue is entirely due to the better prices realised from the sale of rubber brought about by the general restriction of output under Government control.

Government Plantation, Pondok Tanjong.

Mr. F. M. McCormac was in charge of this plantation throughout the year.

The area of the plantation is approximately 607 acres, which is made us as follows :—

Mature Rubber	...	293 acres.
New Clearings	...	300 „
Building sites	...	7½ „
Waste land	...	6½ „

Owing to the necessity for curtailing expenditure all development work on the New Clearings (unplanted) was suspended and at the close of the year arrangements were well in hand for the disposal of this area by Public Auction at the Land Office, Taiping at a reserve price of $30,000/-, which amount was the valuation of the land and buildings thereon at the close of the current financial year.

The planted area has been further improved by thinning out a number of untappable trees. All drains have been cleaned out and bridges repaired where necessary, so that the whole area is now in a very satisfactory condition.

The cost of weeding the mature area was 2.84 cts. per acre per month, which gives a figure of $3.41 per acre per annum, against $2.70 for the previous year. The slight increase in cost was brought about by cleaning up the low-lying area, liable to flooding. The weeding of the new clearings cost approximately 39 cts. per acre per month.

The labour force at the end of the year comprised 59 males and 28 females and 7 minors or a total of 94 Tamil coolies, which is considered sufficient for all requirements. The average daily check-roll wages throughout the year was 39.55 cts. per coolie.

The general health of the labour force has shown slight improvement during the year and a notable decrease in the number of malarial cases has been observed. There were 139 admissions to hospital and no deaths during the year.

All buildings have been maintained in good repair throughout the year.

The whole of the planted area (293 acres) is in bearing and, with the exception of two small areas tapped on a third or alternate days, the system of tapping is one cut on a quarter alternate day.

At the present time there are 17,394 trees being tapped and the number of tapping tasks is 52½. The average bark consumption was under ¾ of an inch per month and cases of wounding were practically reduced to a minimum As might be expected under such a conservative system of tapping, the bark renewal has shown great improvement.

An output of 79,237 lbs. of dry rubber was obtained during the year, which was tapped and collected at a cost of 5.14 cts. per lb. The "all in" cost for the year was 25.80 cts. per lb. against 19.92 cts. per lb. in 1922. The slight increase in cost of production is due to the lower crop harvested under restriction during the period under review.

Out of 12 consignments of rubber despatched to the Singapore Auctions during the year nine were awarded the Singapore Standard price for Smoked Sheet. The average price realised throughout the year was 49·80 cts. per lb.

As will be seen from the statistics given at the beginning of this report the excess of revenue over expenditure for the year was actually $9,247.25.

The result of the tapping experiment inaugurated to test the relative value of the alternate day and periodic resting systems of tapping showed that alternate day tapping was in the end slightly superior to periodic tapping as regards both yield of latex and tapping costs.

Diseases and pests are still troublesome, but every effort is being made to keep them under control. *Ustolina zonata* and *Fomes lignosus* are the most prevalent diseases, whilst a large number of trees are subject to Brown Bast. Pink disease (*Corticium salmonicolor*), Patch Canker and Wet Rot (*Fomes pseudo-ferreus*) are also present, but to a less extent than formerly.

White Ants (*Coptotermes gestroi*) continue to give trouble, but appear to be kept well in check.

Rain was recorded on 209 days during the year giving a total rainfall of 127.69 inches.

Government Plantation, Kuala Tembiling.

Capt. F. J. Ayris remained in charge of the plantation throughout the year.

The area of the plantation is approximately 854½ acres, which is made up as follows :—

Mature Rubber	... 325	acres.
Immature Rubber	... 126	,,
Cleared but not planted	... 11	,,
Building sites	... 9	,,
Reserve land	... 383½	,,

As a result of the curtailment of expenditure the general appearance of the plantation is not quite so good as it was at the end of 1922, it is however, in good condition and the best has been done with the money available.

A large portion of the mature area is planted with *Centrosema Plumieri* and *Dolichos Hosei* and the balance clean weeded. Both these leguminous cover crops do well on this particular type of land, but, owing to the dense shade now produced, the Centrosema is gradually dying out in the older fields. The Centrosema in the immature area is doing well, but is not sufficient to keep down weeds.

The average cost of weeding the mature area (part clean weeded) was $1.01 per acre and that of the immature area (part strip weeded) $2.14 per acre per month respectively. The cost of weeding the immature area shows a considerable reduction on the figures for last year and with the increased shade now being produced a further reduction may be expected next year.

Owing to the necessity of cutting down expenditure, roads, drains and bridges have only been maintained in fair condition throughout the year.

The labour force at the end of the year consisted of 38 males, 13 females and 2 minors or a total of 53 Tamil coolies.

The general health of the labour force has on the whole improved. There were 36 admissions to hospital and no deaths during the year.

Although little or no expenditure has been incurred on buildings during the year, they are all in fair condition and the few minor repairs required will be carried out early in 1924.

Diseases and pests were kept fairly well under control. Pink disease is less prevalent than formerly, but still gives a certain amount of trouble. Isolated cases of *Fomes lignosus* have been recorded and infected trees are treated immediately they are found in order to prevent further spread of this virulent disease. White ants give

practically no trouble and attacks from this pest are very rare. Deer were very troublesome early in the year and did a small amount of damage, but no further visits of this pest have been reported.

Rain was recorded on 182 days during the year, giving a total rainfall of 86.96 inches.

Castleton Estate, Telok Anson.

Mr. T. D. Marsh, Assistant Agriculturist, was in charge of this estate throughout the year.

The area of the estate is approximately 208 acres, which is made up as follows :—

Mature Rubber	...	197 acres.
Coconuts	...	6½ ,,
Building sites	...	4½ ,,

The area under rubber is kept in a clean weeded condition, but that under coconuts is planted up with various catchcrops from time to time. The average cost of weeding was 22.16 cts. per acre per month, which gives a figure of $2.66 per acre per annum against $2.44 for the previous year.

The labour force at the close of the year consisted of 79 Tamils—58 males, 16 females and 5 minors– and 2 others, or a total of 81 coolies. The average daily check-roll wages throughout the year was 39.59 cts. per coolie.

The health of the labour force is very satisfactory. There were 6 admissions to hospital and 2 deaths, one the result of a railway accident, during the year.

Numerous repairs to both coolie lines and bungalows have been carried out during the year and all buildings are now in excellent condition throughout.

The whole of the area planted with rubber is in bearing and, apart, from a number of experimental plots, the system of tapping is one cut on the quarter daily. The total number of trees at the close of the year was 15,807 or an average stand of about 75 trees per acre.

The amount of dry rubber harvested during the year was 83,437 lbs., which is equivalent to an average yield of 423 lbs. per acre per annum. The average cost of tapping and collecting was 7.19 cts. per lb. against 7.42 cts. per lb. in 1922. The somewhat high cost is due to the large area under experiment, which limits the number of trees tapped per coolie.

The " all in " cost of production was 28.50 cts. per lb. as against 29.08 cts. in 1922. This figure includes all experimental

tapping, which is responsible for a considerable increase in working costs. The whole of the rubber was sold at the Singopore Auctions and the average price realised throughout the year was 46.83 cts. per lb., which was quite good, considering the large proportion of experimental rubber.

The various experiments on different systems of tapping, individual yield of trees, early and late tapping, various methods of cultivation, and the effects of thinning-out on yield of rubber were continued throughout the year. Some of these experiments are nearing completion and the final results will be published in due course in the Malayan Agricultural Journal.

The small area under Coconuts is very irregular in growth, but some of the palms are now producing nuts. A large number of the palms were used for inoculation experiments with Bud-rot with the result that many of them were either killed off or had to be removed owing to abortive growths.

Numerous small plots of minor economic crops were interplanted amongst the coconuts and fairly good results were obtained with dry land padi.

Diseases and pests continue to be kept well under control, but Brown Bast still gives trouble and there is little doubt that this is due to the previous heavy system of tapping carried out on this estate. Isolated cases of *Sphaerostilbe repens*, Die back (*Diplodia* sp) are to be found, whilst occasional attacks of both White Ants and Borers (*Platypus lepidus*) have been reported, but these pests do little or no damage.

Rain fell on 155 days during the year, giving a total rainfall of 102.92 inches against 90.40 inches in 1922.

Experimental Coconut Plantation, Sapintas.

Mr. F. G. Parkin was in charge of this plantation until the 3rd April, when he proceeded on long leave. Mr. M. R. Hartley took over from Mr. Parkin and continued to act as Manager until the 29th July, when he resigned the appointment. Mr. R. R. Hartley was then appointed to act as Manager and remained in charge at the end of the year.

The area of the plantation is 2,122½ acres, which is made up as follows:—

Coconuts	...	938.1 acres
Rubber	...	88.6 „
Cleared but not all planted	...	64.3 „
Felled and part cleared	...	57.1 „
Building sites	...	17.3 „
Waste land	...	45.5 „
Reserve jungle	...	901.6 „

The general improvement of the appearance and growth of both the mature and immature coconut areas has continued, which is most satisfactory. Of the young areas of coconuts (tall variety) planted October-November, 1919 a census taken in July showed that a small number of palms were actually in bearing, whilst a large number had reached the flowering stage. The same applies to the areas of Dwarf or King Coconuts planted in September–December, 1920, a year later.

Owing to the curtailment of expenditure, all development work was suspended and, with the exception of supplying a number of vacancies, no planting was done during the year under review.

The area under rubber has continued to show considerable improvement in growth in both the old and the young areas. A census of trees taken in July showed that there were 4,370 of a tappable size, against 3,360 at the same date last year.

Of the area planted with coconuts approximately 245 acres were clean weeded, 200 acres under Giant Mimosa (*Mimosa invisa*), 92 acres under experimental covers, 28 acres under sweet potato (*Ipomea Batatas*) and 425 acres under grass weeding. In every case the best growth has been shown on the clean weeded areas and on this type of land, which is a very stiff clay, the young palms are much more developed than those in the areas planted with leguminous cover-crops.

The whole of the rubber area is still under Giant mimosa, but, owing to the increased shade produced by the older trees, the growth of the cover is somewhat restricted and in parts it is gradually disappearing altogether.

The average cost of weeding the whole of the coconut area was $1 01 per acre per month against $1.64 per acre per month for the previous year. The average cost of weeding the rubber area was 90 cts. per acre per month against $1.03 per acre in 1922. The heavy nature of the soil is responsible for the comparatively high costs of weeding on this particular plantation.

Lalang is still troublesome in the areas under grass weeding, but is kept fairly well under control.

The experiments with various leguminous and non-leguminous cover crops were continued and the following cover crops were under trial at the close of the year:—*Centrosema Plumieri*, *Mimosa invisa*, *Clitoria cajanifolia*, *Doliches Hosei*, *Tephrosia candida*, *Tephrosia Hookeriana*, *Bassiflora foetida* (Passion flower) and *Ipomaea Batatas* (Sweet potato). The area under experiment, including 4 clean weeded controls, was approximately 72 acres. General observations on the growth and appearance of the palms under experiment show that the clean weeded plots and those planted with *Tephrosia candida* are well in advance of the other plots with the non-leguminous covers and grass-weeded plots most backward in growth and the foliage quite yellow instead of the usual healthy green appearance shown in the other plots.

A considerable amount of drainage work was carried out during the year, which included the cleaning out and deepening of the 4 ft. drains on an area of about 365 acres. Some of the 4 ft. drains in Fields 15, 16, 17 and 23 were re-cut so as to bring them properly in between the rows of the palms in the experimental blocks laid down to test the effect of different systems of planting. Scupper drains were cut between the rows of palms in Field 1, but the work was not quite completed at the close of the year.

A new watergate is required to replace the one which has collapsed in Fields 3/4 and it is expected that the new gate will be erected early next year. The other two watergates have worked well during the year and given practically no trouble beyond a certain amount of piling at the outlets.

Mounding up of the young coconut palms in the peat area in Fields 8 and 9 was completed during the year. Other mounding work was carried out in various fields, where the palms had not got sufficient hold and, therefore, liable to get blown over by high winds.

Roads and bridges have been repaired where necessary and are now in very good order.

With the exception of the 116 acre selection block, the whole plantation is now practically clean cleared of all timber.

Supplying was carried out in the younger areas and altogether 1494 plants were supplied in the coconut area and 600 stumps in the rubber area.

The labour force at the end of the year consisted of 159 males. 51 females and 26 minors, or a total of 237 Tamil coolies. This is hardly sufficient for present requirements and it will be necessary to increase the number of coolies to about 300 by recruiting from India. The average daily check-roll wages throughout the year was 38.05 cts. per coolie.

The general health of the coolies was on the whole satisfactory. There were 266 admissions to hospital and 4 deaths (2 women and 2 children) during the year.

All buildings were maintained in thorough repair, the bungalows being re-oiled and the coolie lines lime-washed during the year.

A crop of 216,217 nuts was harvested during the year as against 120,608 in 1922. Of the crop harvested 215,221 nuts were made into copra, producing 838.59 piculs, which was sold at an average price of $10.66 per picul. The balance of 996 nuts were sold to coolies at an average price of 3.49 cts. each.

The average cost of harvesting and making the copra was $1.02 per picul and it took an average of approximately 257 nuts to produce a picul of copra.

The total amount realised for the sale of nuts and copra was $8,939.48 against $4,130.90 for the previous year.

A census of the coconut palms taken in July showed that there were 7,343 palms in bearing and a further 2,072 palms flowering in Fields 1 to 12 (395.4 acres) which is roughly 50% of the palms in bearing on this area. In addition to this there were approximately 3,000 palms flowering on the young areas which were only planted in December, 1919 (tall variety) and December 1920 (dwarf variety).

Diseases and pests on the coconut area gave a certain amount of trouble. A number of cases of Bud-rot and Transverse leaf-break have occurred and diseased palms have either been treated or cut out and destroyed.

The black beetle (*Oryctes rhinoceros*) has done a certain amount of damage, but considerable numbers have been caught, whilst its larvae have also been collected and destroyed. The "Red-stripe" weevil (*Rhynchophorus schach*) is very seldom found. Grasshoppers (*Valanga nigricornis*) have done considerable damage to young seedlings and in many cases they have killed off the young plants. They were found to be harboured by the Giant mimosa (*Mimosa invisa*) being used as a cover-crop and it was necessary to remove the cover crop completely in order to get rid of this pest. White ants still continue to give trouble, but are kept well under control by the pest gang. Wild pig has also been very troublesome during the past year and a considerable number of young seedlings have been destroyed by this pest.

In the rubber area isolated cases of *Fomes lignosus* are reported occasionally, but on the whole there is very little disease present. White ants are, however, somewhat troublesome in this area, but the pest is systematically treated and kept well in check.

Rain fell on 136 days, giving a total rainfall of 84.28 inches against 78.80 inches in 1922.

Experimental Plantation, Serdang.

This new experimental plantation, which has been started with the object of testing out all crops other than rubber and coconuts, is situated at Serdang in the State of Selangor, and is roughly about 14 miles south of Kuala Lumpur.

The area of the plantation is approximately 1,525 acres, half of which is hilly land and the other half either flat or gently undulating. The former, being less suitable for the experimental work now in progress, has been kept in reserve and only the latter type of land has so for been opened up.

At the close of the year an area of about 400 acres had been clean cleared and planted up with various crops and a further area of 165 acres had been felled, burnt and practically clean-cleared ready for ploughing preparatory to planting up further experimental plots.

The newly opened area, consisting of flat land, is particularly suitable for experiments with annual crops and the major portion of it will be reserved for this purpose.

The block of 10 acres specially reserved for a permanent nursery for the propagation of planting material is very conveniently situated in a central position and on the main road leading through the plantation. The whole area is systematically laid out in 1/10 acre plots which is a most suitable size for carrying out preliminary trials with annual crops, which only occupy the land for a comparatively short time. Good wide roads have been placed through and around this area, which is enclosed on all sides by a thick bamboo fence.

Considerable attention was paid during the year to the introduction of new planting material and, out of 48 new species of plants received, no less than 45 of them were definitely established on the plantation. In addition to this must be included 15 new varieties of groundnuts, 7 varieties of *Derris* (Tuba), 5 high yielding varieties of tapioca, 4 varieties of sweet potatoes and 4 varieties of African oil palm.

A further area of about 120 acres was planted up during the year under review, which included the following crops :—Limes 48½ acres, Coffee 15 acres, Nutmegs 10 acres, Pineapple 9 acres, Annatto 4 acres, Gambier 3 acres, Roselle 2½ acres, Tapioca 2 acres, Vanilla 2 acres and a large number of one acre plots of miscellaneous crops.

The following gives the approximate areas of the principal crops which had been actually planted out at the close of the year :—African oil-palm 50 acres, Kapok 50 acres, Limes 48½ acres, Sisal hemp 25 acres, Mauritius hemp 25 acres, Sugar-cane (23 varities) 25 acres, Coffee (7 varieties) 24 acres, Nutmegs 10½ acres, Candle nut 9 acres, Sugar palm 9 acres, Annatto 4½ acres, Manila hemp 4 acres, Papaya (2 varieties) 4 acres, Cloves 3½ acres, Castor oil (3 varieties) 3 acres, Coca (cocaine) 3 acres, Gambier 3 acres, Areca nut 2½ acres, Bananas (approximately 120 varieties) 2 acres, Purging nut 2 acres, Roselle fibre 2 acres, Tapioca (2 varieties) 2 acres, Vanilla 2 acres, Arrowroot, Cocoa, Gingelly, Sea Island cotton, Ramie fibre, Bowstring hemp, Lemon grass, Citronella grass, Vetiver grass, Guinea grass, Rhodes grass, Natal red top grass, Dallis grass, Carpet grass, Napier grass and Merker grass 1 acre each.

In addition to the above areas must be included the permanent nursery of 10 acres fully planted and also a large number of small plots of less than 1 acre.

The nurseries are well stocked with seedlings of various crops which will be required to plant up the new 165 acre block now being opened up.

A large quantity of planting material was forwarded to headquarters for distribution throughout the country and included seeds of Fibre plants, Food crops, Oil-producing plants and numerous Cover crops.

As previously reported an area of 50 acres has been reserved for an arboretum and this is gradually being planted up with small groups of trees and shrubs which are likely to prove of economic value later, when they will be planted out on a field scale in the same way as other crops of known value.

A few new drains have been cut where necessary, whilst existing drains have been cleaned out and deepened with the result that whole of the drainage system is working very satisfactorily. In the ravines a number of foot-hill drains have been put in to collect and drain off seepage purely as an anti-malarial measure. A regular system of silt-pitting was carried out on most of the high land, whilst two small areas of steep land were terraced and citronella grass planted on the contour. These precautions have been taken in order to prevent soil wash as far as possible.

A strong barbed wire fence has been erected along the northern and eastern boundaries of the new clearings and continued on to the arboretum thus practically enclosing the whole of the lower area of the plantation.

Considerable progress was made in the construction of connecting roads on the plantation and these are covered with laterite as transport is available for carrying out this work. These roads have been properly drained and on the higher levels a row of citronella grass has been planted on each side of the road to prevent possible damage from soil wash.

The Public Works Department commenced work at the end of the year on the construction of the new approach road to the plantation and it is expected to complete this road early in 1924. This new entrance road will be a considerable improvement on the existing road as in addition to being much shorter, it is practically on the level the whole way and will therefore do away with the somewhat heavy gradients which are encountered at present.

With the exception of about 40 Tamils, who reside on the plantation, the labour force is composed of non-resident Chinese coolies engaged locally from day to day. So far the employment of casual Chinese labour has been fairly satisfactory but with the present increase in the opened area it is considered advisable to employ a number of Tamil coolies who will be resident on the plantation and thus form the nucleus of a permanent labour force. The average number of coolies employed daily throughout the year was 334 and the rate of pay averaged 43.63 cts. per diem.

Although isolated cases of malaria occurred from time to time, the general health of the labour force was fairly good, there being only 16 admissions to Hospital and no deaths during the year.

The following new buildings were erected on the plantation during the year:—

2 Bungalows for Assistant Agriculturists.

1 Single Garage for Bungalow No. 1.

1 Double „ the Hostel.

3 Quarters for Clerk and Overseers.

1 Set Cooly Lines of 12 rooms.

1 „ „ 20 „

1 Set Kitchens of 4 rooms.

1 „ „ 5 „

1 General Store with office.

1 Cattle Shed of 3 stalls.

1 Dark Room for Photography.

1 Temporary Attap Shed for Chinese Oil Presses.

All existing buildings have been maintained in good repair throughout the year at very little cost.

The loan of 12 Decauville trucks and about half a mile of track was obtained from the F.M.S. Railway for filling in of a permanent site for Factory and Store buildings and good progress was made on this work during the latter half of the year.

As might be expected with such a large number of crops under cultivation, considerable attention has to be paid to the control of diseases and pests. The fact that the whole area has been absolutely clean-cleared of all timber is probably partly responsible for reducing the infection of disease in many of the crops now under cultivation and so far no serious damage has been reported under this heading. The same cannot, however, be said of pests and the ravages of certain insects have caused considerable trouble with the majority of the crops necessitating the employment of both preventative and remedial measures to keep them under control.

At the present time insect pests are so troublesome on some of the crops that the cost of controlling them will probably be the limiting factor against their successful cultivation from an economic standpoint.

The collection of botanical specimens of economic plants for the herbarium has been continued and a number of new plants has been added to the collection during the year.

The average maximum temperature recorded during the year was 92.32° F. and the average minimum temperature 74.64° F., the

highest maximum being 98° F. in April and the lowest minimum 64° F. in February.

Rain fell on 181 days during the year, giving a total rainfall of 81.94 inches.

A large number of visitors were shown round the plantation during the year which naturally occupied the time of the staff to a considerable extent and, as the scope of the plantation increases, it will be necessary to make provision for this contingency.

Official visits were paid during the year by H. E. the High Commissioner (Sir Laurence N. Guillemard, K.C.B., K.C.M.G.) on the 14th February, the Acting Chief Secretary (The Hon'ble Mr. E. S. Hose, C.M.G.) on the 4th June, the Members of the Advisory Committee on the 16th October and the Chief Secretary (The Hon'ble Mr. W. George Maxwell, C.M.G.) on the 5th December.

General.

A further course of lectures in the elementary principles of Agriculture was given to a number of Malay Probationers attached to the Department.

A considerable amount of time was taken up in the preparation of exhibits for the forthcoming British Empire Exhibition and to a certain extent this disorganised the normal work of the Division during the period under review. In addition, a large number of articles in connection with the cultivation of various economic crops was contributed to the Handbook of Malayan Agriculture which is being specially prepared for the above Exhibition.

ANNUAL REPORT OF THE AGRICULTURE, INSTRUCTOR, FOR 1923.

By D. H. Grist.

1. Staff.

The writer continued in charge of the Division for the period under review.

Captain J. M. Howlett, M. C., was transferred to Kuala Kangsar as Agricultural Instructor, Perak on January 21st. From June 18th till December 21st he fulfilled the additional duties of Superintendent Government Plantation, Kuala Kangsar.

2. School Gardening.

The school garden scheme, initiated by the Division towards the end of 1922, has made satisfactory progress. Such difficulties as have arisen have been overcome by means of frequent visits to all schools on the register of school gardens: by the regular publication of articles on the subject in the Malay Agricultural Bulletin of the Department; by a special course of lectures in the Malay language to teachers at the Tanjong Malim College; and at all times, by the loyal co-operation of the Inspectors of Schools.

A preliminary visit was made to thirty-three school gardens in Perak, as a result of which it was decided to register eighteen schools in the State as being under the supervision of the Division. These schools have shewn improvement during the year.

At the end of the year under review, the following school gardens had been included on the register of the Division.

State.	No. of School Gardens.
Selangor ...	14
Pahang ...	10
Negri Sembilan ...	22
Perak ...	18
Total ...	64

as against eight at the end of 1922.

The above is not a complete list of schools in which gardening is included in the curriculum. There are many more in Perak, and the work has been started at the other schools in Negri Sembilan, Pahang and Malacca.

Owing to the large number of "unofficial" school gardens that have been started, and the liability of further supervision by the Instruction Division, arrangements have been made to issue a circular letter stating that the Division will assist all such schools by advice and planting material, and, if especially requested, by a personal visit There has been considerable response from the gurus.

3. Agricultural Shows and Exhibitions.

A revival of interest in agricultural shows and exhibitions resulted from the Malaya Borneo Exhibition in 1922, and an organization (The Malayan Agri-Horticultural Association) has done good work to bring to public notice the beneficial effects of such events. The Instruction Division has been closely connected with the work of this Association, and by combining the interests of the Department of Agriculture with the objects of the Association, has been able to work towards a closer union of the Department with the agricultural shows. The central idea has been that such shows should be educational by shewing the improvement possible in stock by breeding, selection and suitable feeding; and, by including an organized local industries section, to aim towards making the annual show an "annual fair" for the disposal of the much neglected but valuable arts and crafts which in the past were a feature of Malay "kampong" life.

In a memorandum on the subject of agricultural shows it was suggested that all local shows should be held under the auspices of the Malayan Agri-Horticultural Association. The suggestion has been accepted in many cases, with the result of decreasing the cost of such events and improving their organization by making full use of the experience of the standing committee of the Association.

The financial assistance of Government has been of great service to the organizers of agricultural shows, but it is probable that the shows will tend to become self-supporting as the organization improves.

The Malayan Agri-Horticultural Association held its first Malayan Agri-Horticultural Show and Trade Exhibition at Kuala Lumpur on June 30—July 2nd. About 25,000 people visited the show. Apart from agricultural, horticultural, poultry, livestock, local industries, and dog shows, with a trade section, the following Government departments staged special exhibits which proved to be. not only an attraction to the Show, but of considerable value, as publicity, to the departments concerned: viz. Department of Agriculture, Forestry Department, Malaria Advisory Board, Infant Welfare Committee, the Public Health Authority and the Geological Department.

District Shows have been held as under:—

Pahang: Temerloh, Kuala Lipis, Raub (for the districts of Raub and Bentong), Pekan, Kuantan.

Negri Sembilan: Seremban, Rantau (for Rantau and Port Dickson), Jelubu, Kuala Pilah, Rembau (for Tampin District and the sub-district of Rembau).

Perak: Tanjong Malim (for the districts of Ulu Selangor and Tapah), Upper Perak.

An agricultural show was also held in Kedah.

The total number of agricultural shows was therefore fourteen. The Instruction Division give assistance at most of these events, in compiling schedules and stationary, and seeing printing through the press; and assisting in staging and judging the exhibits.

The writer was Honorary Organizing Secretary and Treasurer of the Malayan Agri-Horticultural Association throughout the year.

The Agricultural Instructor served on The Agricultural Sectional Committee (Malaya) for the British Empire Exhibition 1924; and on sub-committees of Finance and Publications in this connection. The latter Sub-Committee have been engaged in editing a second edition of the Handbook of Malayan Agriculture.

4. Publications.

The main work of publications has been an agricultural bulletin in the Malay language, with the title of "Warta Perusahaan Tanah." This was started by the Division at the end of 1922, when the first number appeared. Since then the circulation has increased by 500 copies to 3,000 copies per issue. Four quarterly numbers have been published during the present year. The contents of these numbers was as follows.

Vol. 1	No. 2	...	Editorial. Rubber Restriction. School Gardening. Imports and Exports of Malaya —a discussion of the agricultural possibilities of the country. The Sultan Idris Training College. Tanjong Malim (with illustration.)
Vol. 1	No. 3	...	Editorial. Difficulties of Padi Planters. Co-operation. School Gardening.
Vol. 1	No. 4	...	Editorial. Kapok (with illustration). Co-operation. School Gardening.
Vol. 1	No. 5	...	Editorial. School Gardening. Tobacco cultivation. Co-operation. Note on care of fruit trees.

At the request of the Controller of Rubber Exports, F.M.S. and S.S., a reprint of 5000 copies of the article on Rubber Restriction was supplied to his office.

The writer acknowledges the assistance of the Co-operative Department, and the Dato Penghulu of Rembau for preparing the articles on Co-operation.

The publication of Warta Perusahaan Tanah resulted in increased correspondence with Malay cultivators throughout the Peninsula. About fifty such letters were dealt with, including requests for information on padi, padi pests, tobacco, cotton, roselle and areca nut cultivation, and enquiry for planting material and previous publications of the Department.

Over one thousand copies of the old series of Malay Publications of the Department, dealing with special agricultural subjects, have been distributed during the year, mostly by special requests for copies, but a few at agricultural shows.

Other publications of the Division during the year are as follows :—

Kapok : Malayan Agricultural Journal Vol. XI, No. 1.

Annual Report of Instruction Division 1922" " Vol. XI, No.

Previous examination papers set under the Scheme for Malay Officers of the Department of Agriculture.

5. Kapok.

In continuation of the work of the Instruction Division in 1922, efforts were made in the year under review to interest European enterprise in the purchese and grading of local kapok, and to stimulate Malays and others to give the existing trees more care. As matters stood, a large proportion of the kapok on the banks of the Perak River,—the chief source of supply—was not harvested, as the Chinese price for kapok was considered too low, unless the owner was in debt to the Kapok purchaser. A European interested in this crop undertook to purchase uncleaned kapok. The favourable price offered by this gentleman resulted in a larger crop being harvested. Absence of cleaning machinery and competition from the Chinese buyers, who then bought at higher prices and sold at lower prices, closed the season's work, which, while not a success, from the buyer's point of view yet resulted in renewed interest in the crop on account of the better prices obtained. As it was 50 piculs of kapok was bought in three days.

Propaganda work in English and Malay stimulated increased planting, and there is a demand from several European planters for seed from the next crop in 1924.

This Division suggested a scheme for purchasing kapok from the 1924 harvest, in order that interest in the crop may be sustained. It is the aim of the Division to educate the Malays to harvest and market their crop by co-operative effort.

6. Fibres and other Crops.

The demand for roselle fibre seed for planting on a small scale in "kampongs" and school gardens continued throughout the year, and has been fostered by the Division. Several failures in germination and growth are reported. The planting of this crop needs very careful consideration as to season and soil conditions, and further investigations are necessary. The marketing problem is similar to that of kapok and is receiving consideration by the Division.

The Agricultural Instructor Perak has commenced experiments on the cultivation of *Urena lobata*; Pulut pulut (M)., a way-side weed which is found growing—often under considerable shade—throughout Malaya. It was hoped that areas might be found where the plant was sufficiently plentiful to make collection of wild stems a commercial possibility, but it is now thought that cultivation of the plant will give better results. Stock of fruit trees, and other planting material has been distributed to Malays from Kuala Lumpur and Kuala Kangsar.

7. Educational.

The writer acted as Agricultural Instructor to the Sultan Idris Training College, Tanjong Malim, in addition to his other duties, throughout the year. Two days weekly have been employed at the College. The present courses of lectures and practical work are delivered to nine classes, a total of two hundred students.

The progress made, and the interest taken by the students in this branch of their work at the College, has been an encouraging feature of the course.

A special course of six lectures in Malay, with demonstrations, was delivered at the Sultan Idris College to a vacation class of one hundred vernacular school teachers.

8. Scheme for Malay Officers of the Department of Agriculture.

The arrangement of all courses of lectures and examinations held under this scheme was carried out by the Instruction Division.

The unsatisfactory results obtained under the present scheme of Malay training in the Department has been the subject of much consideration during the year. In the first place it is realised that the

very imperfect knowledge of English which the majority of the Malay officers possess, militates against their progress under the present system. The Agricultural Chemist, Chief Agricultural Inspector and the writer submitted a memorandum on the subject early in the year. Later, a departmental committee was appointed to consider the training of the Malay officers of the Department. In general terms, the two reports agreed that Malay officers on entering the Department should be put through a course of training at a School of Agriculture. A satisfactory course of this description would be followed by service in the Department, where the officer could rise to the post of Senior Agricultural Assistant without further examination. Normally, officers for Prize Appointments should undergo a higher course of training than can be given in a School of Agriculture.

9. Conference of Penghulus, etc.

An endeavour was made to bring the native cultivator, through the Penghulus, more closely in touch with the work of the Department, by meeting individual penghulus in their Mukims when occasion permitted ; and also by holding conferences of penghulus in the districts. Conferences between the Division and Penghulus were held at Batu Gajah, Parit, Lambor, Kuala Lipis, Raub and Jelebu.

10. Demonstrations.

Under the scheme of instruction work, as at present constituted, demonstration work is the duty of the Inspection Division. In practice demonstrations are arranged by either Division, or in co-operation.

Penghulus of Seremban District visited the Government Plantation, Serdang in May, and were shewn modern methods of cultivation and planting, and a large number of crops.

Demonstrations of roselle fibre preparation were held at Kapar and Klang by the Assistant Agricultural Inspector Selangor and an officer of the Instruction Division.

With the valuable assistance of the Manager, Triang Estate, a demonstration of roselle fibre preparation was held at the Temerloh Agricultural Show.

The Agricultural Instructor, Perak has given demonstrations of tobacco-growing and curing, roselle-retting, string and rope making, cotton-ginning and kapok-cleaning. Most of these demonstrations have been held on the Government Plantation, Kuala Kangsar.

11. General.

A visit was made to the Perlis Phosphate Caves. Analyses by the Agricultural Chemist of samples collected by the writer shew that

the caves contain a fertilising material of considerable value. It would appear that the present difficulty of the syndicate working these deposites is that of transport. Could this problem be overcome, there are already strong indications that the fertilizer would find a ready market in England and elsewhere.

Visits have been made by officers of the Division to many estates, small holdings and kampongs. By constantly visiting Malay holdings the Division are kept informed of the needs of the native cultivator. The writer served on a Departmental Food Production Committee, which has considered ways and means of increasing the food supply of the country.

ANNUAL REPORT OF THE PLANT PHYSIOLOGIST FOR 1923.

By W. N. C. Belgrave.

The staff of the Division remained unchanged throughout the year.

I have again this year the pleasure of expressing appreciation of the keeness of my Malay Officers.

In February, in addition to my own duties, I took over from Mr. F. de la M. Norris, who proceeded on leave, the supervision of the Departmental Library and the Editorship of the Malayan Agricultural Journal.

In December I took over from Mr. Jago—transferred—the routine duties of Assistant to Secretary for Agriculture and of Accountant.

Work during the year has been almost entirely confined to rubber.

Rubber.

Latex.—The lines of work mentioned in my last annual report were continued, and an account of a portion of this work was published in two articles in the Malayan Agricultural Journal, Vol. XI, No. 12, December 1923; to this periodical further reference should be made for details.

The first article—on coagulation—gave an account of work on the subject, and in it the view was developed that it was unnecessary to postulate an enzyme in latex, and that the phenomena met with in normal latex could be explained by the assumption of a film around the caoutchouc globules, this film being such as is demanded by the theory of surface tension, and containing one (or more) proteins with an iso-electric point at the coagulation point of latex.

The second article—with Mr. R. O. Bishop, Assistant Agricultutural Chemist, dealt with observations on some nitrogenous and other bodies in latex,

Brown Bast.—Throughout the year, general attention has been given to brown bast. An attempt experimentally to produce the affection on a number of trees by very heavy tapping signally failed. It is not improbable that this failure is associated with the fact that the trees were poor in quality and yield, and had been badly over-crowded.

Systems of tapping.—Experiments with girdling cuts (2 Vs) at long intervals (4—5 days) were continued. No injury to the trees under experiment could be detected, nor did the yield diminish to an

excessive extent. At present the system is of scientific interest only, but it is not impossible to imagine circumstances which might render any system which enabled the number of skilled tappers to be reduced to be of great practical value.

The experiment will be continued.

Bud-grafting.—Although no practical work on the problems has been possible, results elsewhere have been followed with interest. A lecture was given under the auspices of the Malacca Planter's Association on July 8th.

The view taken at the lecture was that previously stated in various numbers of the Malayan Agricultural Journal—that bud-grafting, instead of being a proved success as a commercial operation, was on the contrary an experiment, and that a considerable period must elapse before any definite conclusions positive or negative can be drawn; in the meantime it was urged that those who wished to plant bud-grafts should interplant with seed stock, to minimise possible loss.

I was nominated by Government to be a member of a Committee of technical Officers appointed to report on "Certain proposals made to the Government for the formation of a co-operative society of rubber growers to undertake bud-grafting and seed selection of Hevea brasiliensis."

This Committee reported to Government on 25th July.

During the course of the year there was a considerable moderation of the previous optimism as to the success of bud-grafting, and it is not too much to say that 'bud-grafting' *in the form first advocated*, is now regarded with considerable suspicion. Tapping results as far as they have gone, show that it is not the case that any high yielding tree is capable of passing this character on the bud-graft off spring; and it is recognised that the raising and tapping of a clone of scions from each selected mother tree is, at present, the only way in which suitable parent trees can be discovered.

Other Crops.

Nipah.—A start was made towards the end of the year in an investigation with Mr. J. H. Dennett, Assistant Agricultural Chemist on the biological problems of the extraction of juice from the Nipah—Palm; this had to be put aside on account of pressure of other work—it was however, found that, at any rate on the plot experimented with, and at the period of year under review, no great difficulty was likely to be met with in controlling changes in the composition of the juice which might be detrimental to alcohol fermentation.

Departmental Library.—The work of registering all publications in the Library was completed, and the compilation of alphabetical indices for Periodicals, Annual Reports and Books started.

Departmental Publications.—The Malayan Agricultural Journal appeared regularly throughout the year– longer articles included :—

Kapok by D. H. Grist.

Rice in Malaya by H. W. Jack.

Production of Alcohol from Nipah Palms by B. J. Eaton and J. H. Dennett.

Factors affecting rate of Vulcanization of Plantation Rubber by R. O. Bishop.

Studies in Hevea Latex :—(1) Coagulation by W. N. C. Belgrave.

Rice in Malaya was subsequently reprinted as Special Bulletin No. 35.

Two Special Bulletins by the Government Entomologist on "The Two-coloured Coconut Leaf Beetle," and "Red Stripe-Weevil," should have appeared, but were delayed by the non-receipt of reproductions of illustrations.

SISAL IN MALAYA.

Information lately received from the Imperial Institute, London ; (Bulletin of Imperial Institute, Vol. XXII, No. 1, 1924) indicates widespread interest throughout the British Empire in sisal hemp.

The Department of Agriculture is keenly alive to the commercial possibilities of the cultivation of this fibre in Malaya and has recently been devoting particular attention to the investigation of this matter.

Details of the work so far carried out in the field and in the factory are being collected for early publication in this Journal.

Samples of fibre grown at the Experimental Plantation, Serdang, and prepared in the Department of Agriculture, have this month been despatched to London for valuation and report.

R.O.B.

1st August, 1924.